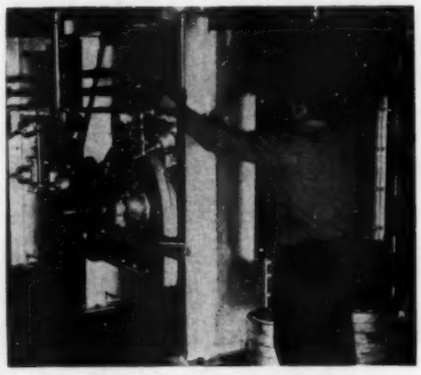
AMERICAN MACHINIST

August 9, 1939



Turning on the Heat—*This continuous furnace is one of many new pieces of equipment used by Forsberg in making better hacksaw blades (page 589).*

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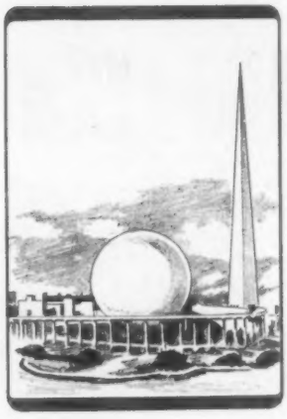


Been to the World's Fair yet?

When your friends ask you that, they go right on to shoot a volley of suggestions like, "Don't miss General Motors and Ford", "Be sure to get to GE's lightning laboratory and the A.T.&T. Voder", "Be sure to get over to the foreign section and see the Soviet and British buildings", "Don't miss the fountain and fireworks!"

Why? Because they know the Fair is so big you couldn't expect to see all of it in a month. They're trying to save you time and still be sure you don't miss exhibits they found of interest.

We're making the same suggestions about the Machine Tool Show. It's a tremendous show, with more than 200 exhibitors and over 3 acres of working exhibits. You're going to be interested at every turn. You can't see it all. But there are certain things you'll want to be sure to see, no matter how limited your time. They're the types of units you'll be buying next.

We're not making any specific suggestions, except that you be sure to study our Machine Tool Show Number, which will come to you Sept. 20, two full weeks ahead of the Show. That will give you plenty of time to study both editorial and advertising closely and to plan your visit accordingly. Don't miss the exhibits you'll want to be sure to see — use the Machine Tool Show Number of AMERICAN MACHINIST to find them.

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Hacksaw Costs Hacked

Modern machining methods, a new continuous hardening furnace and an air-conditioned finishing room save pennies on a production job

By RALPH D. HAWKINS
Industrial Engineer
The Bridgeport Gas Light Company

Hacksaws start as steel sheets fed to the machine by hand and inched along automatically as the blanks are stamped out

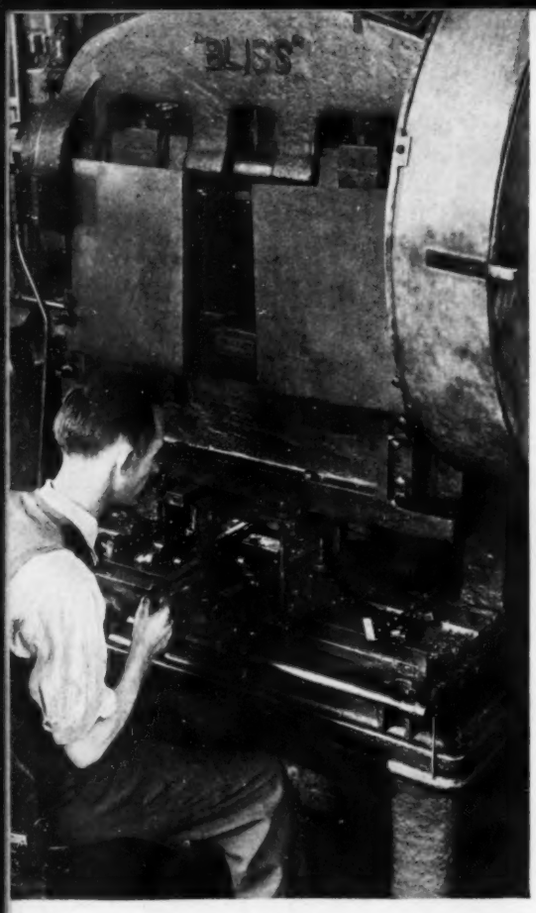
IN MAKING small mass production items, like hacksaw blades and screw drivers, every little improvement in manufacturing procedure makes a whale of a difference in both the quality and the cost of the finished product. In manufacturing a complicated scientific instrument with hundreds of hand-made parts, a few cents saved in the fuel cost for heat-treating a lever or a sping wouldn't amount to much. But with hacksaws it's different. A fraction of a penny saved, a few per cent decrease in rejects, or the elimination of scale in a single hardening operation can make the difference between success and failure.

The Forsberg Manufacturing Company produces approximately 150,000 hacksaw blades and 30–40,000 screw drivers a week (as well as hacksaw frames and other items of hardware) and does it with ingenious machinery and heat-treating equipment. Years of research have gone into the development of the unusual hacksaw blade manufacturing procedure. According to Forsberg engineers, the cutting and setting of the teeth and the heat-treating of the finished blade make the hacksaw.

The raw sheet-steel stock, 2 x 6 ft. is first blanked and then fed to the trimming press where the ends are rounded, the holes punched and the trade mark stamped, all in one blow. Next the blades are clamped to the table of the tooth cutting machine—2,200 at a time—and here the real ingenuity of the plant starts to show up.

The blades are clamped on edge, side-by-side—an eighth of a whole day's production at once—and the teeth machined as precisely to form as the teeth on the finest gears. The cutter is automatically indexed horizontally along the stationary head of the machine, one tooth at a time, as the bed (and its charge of blanks) rides back into position after each cutting stroke.

The cutters are of high-speed steel, 2 in. thick, and range from 3 to 5 in. in length. On the cutting face of each tool are two rows of teeth, one directly behind the other, each tooth in the first row taking a roughing bite for the finishing form directly behind it. Depending upon the stock and the tooth form being cut, there are four to



Ends of the blanks are rounded, holes are punched and the trade mark is added in a single press operation

32 cutting teeth on each toolblock, and these are graduated in height so that the full gullet depth is developed on the saw blades gradually in a number of passes. It is noteworthy that this method of tooth cutting permits undercut teeth, an outstanding feature of the blades. Because of this undercut, hacksaws can be made actually to "cut under and lift out" the steel being sawed, much in the manner of a milling cutter's action. Another feature of the tooth-cutting machine is that the tools for it may be sharpened in 7 min. It used to take half a day to sharpen the old-style cutters.

Another special machine, designed and built at the Forsberg plant, is used to "set" the teeth subsequent to cutting. It is claimed that the most common error in hacksaw blade manufacture is to permit a variation in the tooth "setting," i.e., the angle between the plane of the set teeth and the plane of the blade proper. Generally such variations are caused by variations in the thickness of the stock, and average 0.003 in. The new apparatus sets teeth without appreciable variation regardless of differences in sheet thickness. The blades are automatically fed and carried along between guides, and the setting tools on reciprocating arms move up to form each tooth positively from both sides. The unit has a capacity of 250 ft. of saw blade per min.

In the heat-treating department low costs, high accuracy and uniform standards are maintained, not so much through the use of unusual equipment, as through the thorough fuel and process engineering of each step. A 530 B.t.u. per cu. ft. city gas is used throughout the plant to supply all heat requirements, and is boosted from city gas pressure to 10 to 12 lb. per sq. in. in a compressor before being distributed to the burners of the various heat-treating units.

Batch operation, although still in for the lower production items, has been practically discarded for all main-run jobs—and with startling economies.

The old set-up for hardening includes two batch pot-type furnaces with refractory wall incased in steel shells—one for preheat and one for high heat. The pots, respectively, are 20 and 14 in. in diameter, both 30 in. deep, and each is heated with four single-stage, velocity type gas burners firing tangentially into the combustion chamber and surrounding the pots with swirling hot products of combustion. Hacksaw blades are suspended in these pots from special hangers, and atmosphere protection is provided by forcing city gas into the covered pots. Temperature is controlled automatically through thermocouples located both in the pots and in the combustion chambers, millivoltmeter controllers being used to actuate motor valves in the appropriate gas lines. Heating periods are closely controlled with the aid of a time clock. Special extra-tough molybdenum steel blades are previously dipped in borax to eliminate losses of molybdenum from the surface at heat-treat temperatures.

Quenching is done in hot oil, and the blades are removed while still warm. Immediately they are clamped in steel frames to prevent warpage during the drawing operation. The temperature of the oil is always main-

TABLE I **ECONOMIES AND PRODUCTION IMPROVEMENTS resulting from use of new continuous hardening furnace**

1. Labor

(a) Ten per cent reduction in labor cost for loading saw blades on conveyor. Previous equipment required that blades be hooked individually to hang from conveyor.

(b) Eighty-five per cent reduction in furnace labor on screw drivers, because of random charging on conveyor, as compared to placing on pans previously employed in batch operations.

(c) Fifty per cent reduction in labor of clamping saws in frames preparatory to tempering, because of the straight condition of work as it comes from quenching oil.

(d) Ten per cent reduction in labor of polishing screw drivers, because of the elimination of scale and production of straight work.

2. Fuel Cost

(a) Twenty-five per cent reduction in gas consumption.

3. Quality of Work

(a) More uniform hardness, varying only 1½ to 2 points (Rockwell C scale) in an entire lot of screw drivers.

(b) Increased physical properties of screw drivers resulting in complete elimination of dealer rejections on account of faulty heat treatment.

(c) Improved quality and wearing ability of saw blades by elimination of "soft skinning" due to decarburization. The new furnace provides protective atmosphere for the work.

(d) Improved appearance of hacksaws by elimination of loose oxides.

(e) More uniform hardness of saw blades resulting by test in more cuts per blade.

(f) Establishment of and compliance with more rigid specifications (set up by producer company) as to the straightness of saw blades.

tained within one or two deg. F. of the desired temperature by means of steam and cold water coils within the quench tank.

The drawing oven in the old set-up is of the hot-air forced convection type with a heat chamber 30 in. long, 27 in. high and 18 in. wide. The combustion space is below the heating chamber and is fired with four atmospheric nozzle-type venturi gas burners. Hot products are pulled up from the combustion chamber, into the heating chamber, and around the work. Again, automatic temperature control is provided. While the oven has an effective heat range of from 300 to 1,250 F., it is actually operated from 1,050 to 1,100 F.

The above described procedure although successfully used for many years, and still employed for the lower production items, has now been replaced by a modernized, thoroughly automatic, mass-production hardening-quenching-drawing unit which has made possible the economies and improvements listed in Table I.

The new hardening unit is of the full muffle continuous-type. Bright hardening is obtained through the use of a special atmosphere gas within the muffle. The furnace is 4 ft. wide and 14 ft. long including the quench tank, although the muffle is only 22 in. wide and 14 in. high. Running through the muffle is a moving plate conveyor 18 in. wide which operates between a fixed reel under the hopper and an adjustable reel in the quench zone, at the other end.

Heat is supplied by ten two-stage high pressure, velocity-type gas burners, five on a side, six over-firing and four under-firing the muffle. Temperature control is automatic through a thermocouple, an indicating and control potentiometer, and proportioning motor valves. Work is charged in bulk into the hopper, and discharged directly into the oil quench tank through a hole in the bottom of the muffle at the other end. The furnace has a capacity of 250 lb. of gross work per hour.

As in batch operations, the quench is in oil, the temperature of which is carefully regulated by steam and cold water coils to within one or two degrees of the temperature desired.

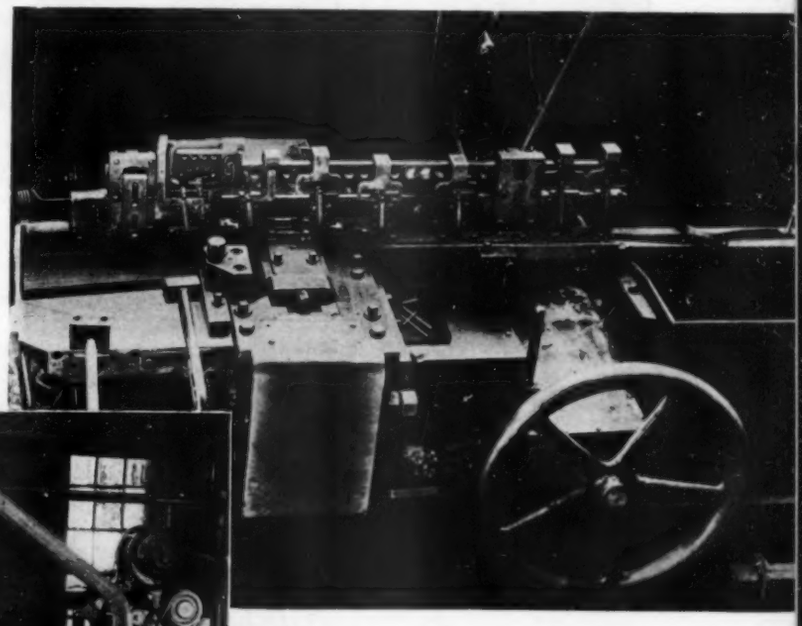
Immediately after the quench, and preparatory to drawing, the blades are clamped, 200 at a time, in steel frames. This is done much as in batch work—but with far greater ease and efficiency. Drawing is in hot oil kept at 300 to 400 F. by means of atmospheric gas pipe burners located below the tank. A Rockwell hardness of 62 to 66 is attained.

Actual operating data on the continuous furnace are given in Table II and indicate the efficiency with which the unit operates. The 25 per cent reduction in fuel consumption, the fourfold savings in labor, and the remarkable improvements in quality of work, all listed in Table I, more than justify the cost of the installation.

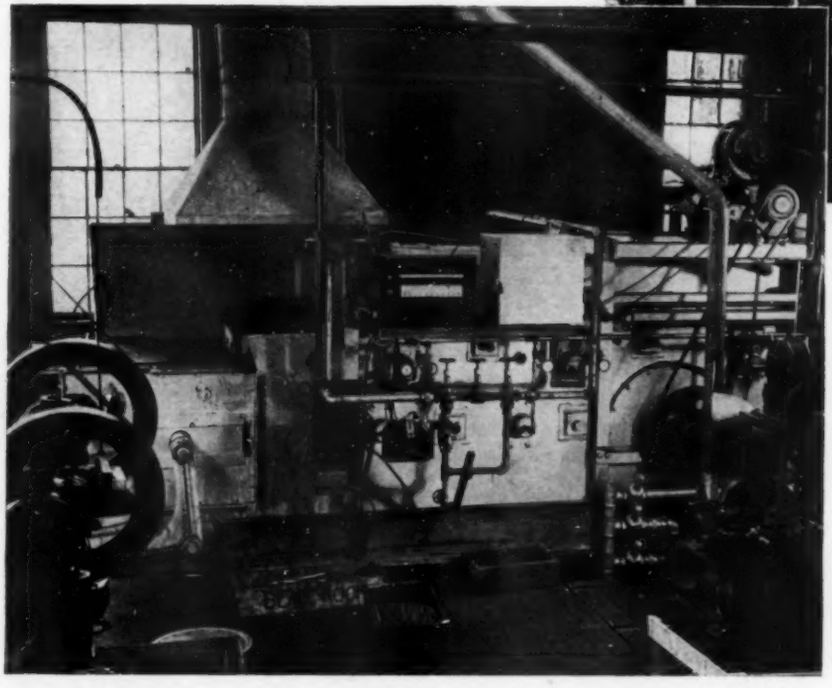
Certain types of hacksaw blades and all band saw blades must have flexible backs along with hardened teeth. To achieve this end a novel piece of flame-hardening equipment

TABLE II **OPERATING DATA on new continuous hardening furnace**

To heat furnace from cold to 1,575 F...	5,900 cu. ft.
To hold furnace at 1,575 F. (per hour) .	700 cu. ft.
Atmosphere gas per hour.....	420 cu. ft.
Average gas to heat 100 lb. of work to 1,575 F.....	94 cu. ft.
To hold furnace at 1,250 F. (per hour) .	349 cu. ft.
To heat furnace from 1,250 to 1,575 F..	1,180 cu. ft.

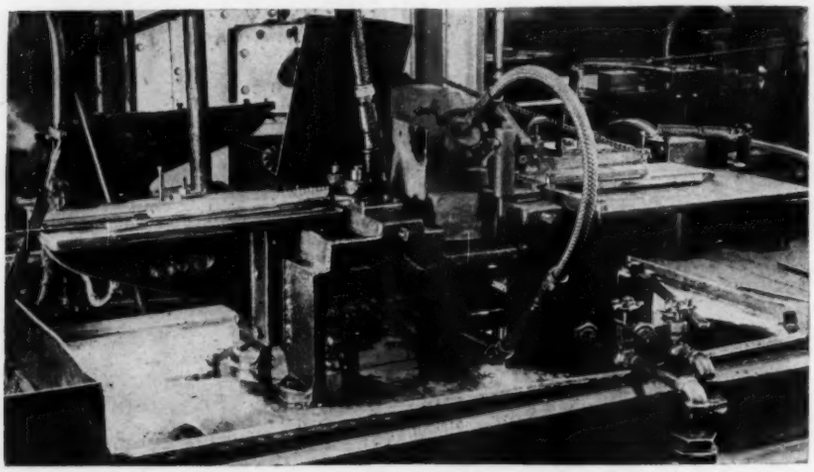


Teeth are set at 250 ft. per min. in a special automatic machine which compensates for variations in stock thickness, commonest of errors in hacksaw blades



Controlled-atmosphere hardening in this continuous full muffle gas furnace has cut fuel costs and improved uniformity, freedom from scale and straightness of the work

has been designed and built wholly within the Forsberg plant. As can be seen, the unit is small, treating but one blade at a time, but continuous in operation. It consists of two stationary steel plate guides between which the blades pass, teeth up. Two sets of small rolls at either end push and pull the blades to feed them through the unit. The teeth, which are exposed above the guides, are heated by three small blast-type gas burners firing down upon them. Quenching is accomplished by a stream of oil pouring down on the teeth as the blades leave the guides.



Teeth of flexible-back blades are flame hardened as they move continuously between guides and quenched by a stream of oil one inch beyond the flame chamber. Oil temperature is varied with blade thickness

As there is about an inch of travel in cold air between the last burner and the quenching stream of oil, the teeth are heated to a temperature about 100 deg. F. higher than that attained in the continuous furnace above described. Thus the cooling effect of the air travel is compensated for. The temperature of the quenching oil ranges from 75 to 100 F. according to composition and thickness of steel being treated.

Next, these flexible-back blades are drawn in the same oil bath as used for the regular run of hacksaw blades. Finally, the ends of the blades are annealed to a dead softness so that the eyes will not pull out. For this anneal a slowly revolving drum with hooks to support each blade is provided with gas burners on each end. The blades are fed to the hooks from a slide, the ends protruding over the gas flames as the wheel rotates. Blades are discharged automatically into boxes at the low point in the wheel travel.

Another forward-thinking refinement of operations can be found in the finishing room where the handles of screw drivers, hacksaw frames, etc., are lacquered. This room is air conditioned by a gas-fired silica gel dehumidifier equipped with a dried-air cooler above it consisting of banks of tubing through which cold city water flows.

Lacquers are sprayed on the work in booths equipped with hoods and induced draft. Before the air conditioning, delayed drying caused by high humidity was a troublesome factor many times during the year, and there were long summer periods when humidities were so high that no drying could be done at all. The plant is located on Long Island Sound adjoining a shipping pier—a situation which aggravated moisture conditions.

The gas dehumidification unit, however, removes most of the moisture from air which is then forced through the cooler into the finishing room. The room is 18 x 35 x 10 ft. high (6,300 cu. ft.) and the unit delivers 600 cu. ft. of well dried air to it per minute. The windows and door, of course, are kept closed.

Year-round control of temperature is achieved by the manner of using the dried-air cooler. Cold water circulates through the coils to cool the air in summer, while steam passes through the coils to warm it in the winter. The conditioned air enters the room at a point close to the ceiling and, after circulating and taking up the moisture and lacquer fumes, is collected in perforated pipes, along the floor and next the walls, which are connected to an exhaust fan.

With the new system, lacquering operations are never interrupted and drying is speeded up under all conditions. In fact, a uniform drying period has now been established which is maintained throughout the year and is from 25 to 50 per cent shorter than the drying periods previously attainable under the best circumstances.

Modern Handling of Steel Sheets

By JOHN E. HYLER

CLOSE OBSERVANCE of accidents in the handling of sheet steel has led to the adoption of means to avoid them. We find gloves and hand pads in use, for instance, so far above the old hand protectors made from burlap and discarded chunks of belting, that there is no comparison. Some of these have a steel ribboned surface, actual ribbons of steel being woven into the palms of leather in such a way that it is next thing to impossible for them to be cut through when handling heavy sheets.

Safety in steel-sheet handling also extends to handling by crane and by hoist, for modern sheet lifters are so constructed that they have an automatic clamping or safety gripping action on the steel. Some of these devices handle an entire package of steel, instead of a single sheet, thereby making decided savings in the cost of handling, as well as a decided contribution toward safety.

A modern idea is the handling horizontally of sheet steel of practically any thickness, whether to shears, brakes or other types of machinery, or into and out of storage. This is done with ease through the use of a special horizontal standard, on top of which has been mounted a ball that will turn in any direction. Such ball-type units are used in multiple applications, being placed as closely together or as far apart as may seem best adapted to the particular stock being handled.

Visit the Machine Tool Show

By WALTER TANGEMAN

Vice-President, Cincinnati Milling Machine Company
Chairman Show Committee, National Machine Tool Builders Association

IF THE PRESIDENT of a large manufacturing company got word from his sales manager in a distant city that a deal was pending which might mean an extra $100,000 in net profits, the president would catch the next train to get there and close the deal.

If a banker, or a member of an investment banking firm, called the president of a large manufacturing company and told him that by a judicious plan of refinancing his interest charges might be cut $100,000 a year, the president would take the next plane to put the project through.

It is not surprising, therefore, that top executives of many manufacturing companies are already sending in reservations for next October's Machine Tool Show. There are, in my opinion, far greater profit possibilities for most companies in this show than are to be found in sales expectations or financing possibilities.

The developments along the line of increased productivity and improvement in design to be displayed at this coming Machine Tool Show are worthy of the personal study and attention of the major executives of all industries using machine tools. To understand fully the possibilities inherent in such developments requires the thinking of men trained to analyze the situation in terms of net profits as well as in terms of technical advances.

By way of substantiation of this statement, suppose we analyze briefly the situation confronting the average manufacturer today. Profits, on the average, have not been satisfactory. Some manufacturing concerns have, of course, been earning a fair return, but in the larger number of cases profit margins have been too small. Some firms have just been able to break even. Certainly most companies are striving for larger profits and are seeking for means which will help them attain this objective.

Now, where are additional profit margins coming from?

Certainly they are not going to come out of wages. The social, political and economic philosophy of this country today demands the best possible wage rates. In fact, machine tools have helped to enable employers to pay good wage rates because they have increased productivity per employee. Certainly a man working with a machine tool can earn far more money than a man working with his hands alone. In any event, it certainly would seem improbable that any possibility of lowered wage rates could figure in next year's profit planning.

What about material costs? At this writing it seems probable that they will remain fixed at approximately present levels. At any rate, there seems little expectation of being able to squeeze any additional profit margin out of material costs in 1940.

How about overhead? The probability is that over the last twelve months overhead has been cut to the limit; and yet all possible measures which may have been taken have not been enough to make any substantial improvement in profits.

How about taxes? This is a subject

which makes tempers go permanently bad and drives profit hopes into the cellar.

How about increased sales? Of course if a company can succeed in substantially increasing its volume the probability is that it may achieve a larger profit, even in the face of rising taxes and rigidity of wages, material costs and overhead expenses. I say "probability" because this is certainly not true in all cases. In most companies, however, a certain volume enables the company to reach a breakeven point, and increases in volume above that point are reflected in increased earnings.

But are there sound grounds today which will lead the manufacturer to assume confidently that he can substantially increase his volume in 1940? Of course every company hopes for such an increase. Of course we are all of us inclined to believe that the business outlook is going to be better, and that 1940 will show an upturn. I myself subscribe to this opinion. But we have all of us been disappointed in such expectations in the past—and we may as well recognize that as long as present conditions prevail there certainly is no definite assurance of a comfortable boom waiting just around the corner.

So there we are. Larger profits are not coming out of wages, taxes, materials or overhead. They may come from increased volume, if such volume materializes.

In the face of this picture, what can be done to *insure* more satisfactory results in 1940?

About the only avenue definitely still left open for increased earnings is the path of lower production costs; and this path leads directly into the October Machine Tool Show.

BETTER MACHINE TOOLS CUT PRODUCTION COSTS

1. By increasing output per man. This represents a tangible saving of production costs which can be computed arithmetically.

2. By making possible a higher quality of product. Year by year more stringent demands have been made upon machine tools with respect to accuracy. Tolerances have been growing steadily smaller. In today's competitive picture quality is becoming an ever more important factor. The problem is how to turn out a *better* product at the same or at lowered cost.

3. By making work easier. Today the arrangement and the placing of controls are given a degree of attention unheard of not so many years ago. From a purely mechanical standpoint a machine tool might operate just as efficiently if one lever could be reached only by standing on tiptoe and another by kneeling on the floor. But in practice, what would be the productivity of this machine? The easier a machine is to operate, the more work is turned out on that machine. Proper allowance must be made for the human element—and this allowance today is actually built into the design and construction of the machine tool.

In the first place, the manufacturer who succeeds in cutting his production costs below present levels gains assurance of a better profit even if business should be no better next year than it is today.

Secondly—the manufacturer who cuts his production costs puts himself in an infinitely better strategic position to meet tomorrow's competitive conditions, no matter what those conditions may be. For lowered production costs may enable him to offer his customers more value per dollar—and more value per dollar may lead in turn to greater volume of sales, or to a larger proportion of such sales as may be obtainable in the light of 1940 business conditions.

The president of a manufacturing enterprise should come to the Machine Tool Show to talk profits with machine tool engineers who talk this same language.

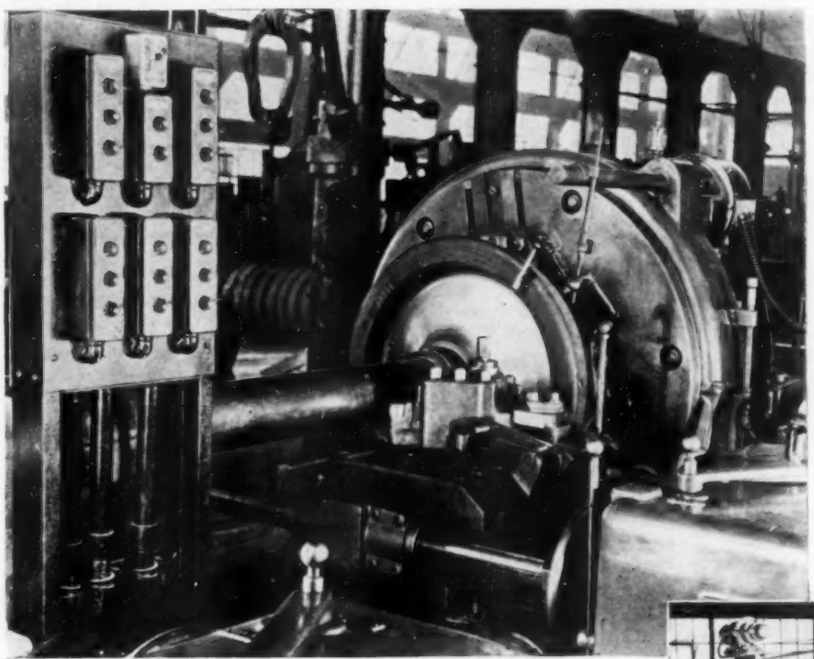
Gathered at the Show will be practical machine tool men who are really profit engineers. Month after month and year after year these men figure production costs, calculate savings in production costs, and estimate increased productivity.

The chief executive of a manufacturing company should bring his production men and his engineers to the Machine Tool Show. It is their job to study the mechanical operation of the machines. It is their job to be able to report from personal observation whether the profit possibilities outlined by the machine tool engineer will actually be backed up by the performance of the machines.

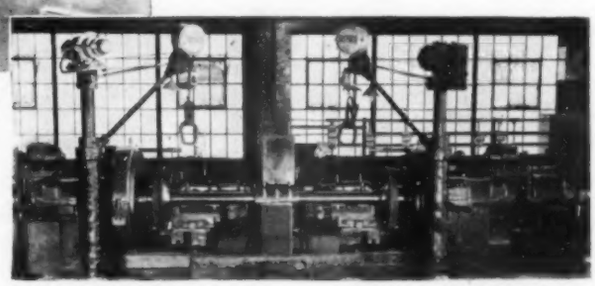
Somewhere in the October Machine Tool Show—in increased productivity, in greater accuracy, in greater ease of operation—there lies waiting a potential profit for every machine tool using manufacturer in this country. We are expecting major executives from practically every industrial field to come to the National Machine Tool Show in search of better profits for 1940.

For Employee Comfort—*Modern cafeteria, left, and well equipped auditorium available for civic functions find favor with open house visitors at Monarch Machine Tool Company's new air-conditioned plant addition in Sidney, Ohio*

Piano-Player Control For Carwheel Contours



To form the wheel web the roughing tool is fed automatically



Two wheels are machined at once while held in line on a mandrel

GROWING use of light-weight streamlined railroad trains has created a demand for carefully balanced carwheels. A large producer in this field is currently meeting this demand by machining the wheels all over. Previous attempts to perform this operation proved expensive. But through the application of a special lathe built by William Sellers & Company, the required contour is now formed automatically. A feature of the machine is the use of a perforated paper roll similar to that used in a player piano.

The work consists in machining the contour of the rim, web and hub body, covering the area of the wheel from the point of intersection of the face of the rim with the inner edge of the rim, the entire web and hub body to the point of intersection with the face of the hub. Centrifugally cast steel carwheels have several risers which are removed during machining. In addition to better balance, finishing the wheels all over aids in the detection of cracks before the wheels are put into use.

The machine is of double-head design equipped with two faceplates for machining two wheels at a time. One head is equipped with reduction gears to obtain the correct speed, and from it the second head is driven through a shaft which passes under the bed. The wheels are mounted on a mandrel which takes the place of the standard axle in order to keep the wheels parallel and in line. They are held in the faceplate by chucks with cams and jaws moved into position electrically.

The tools are held in turrets on the carriages for each head. Cutting is done with one roughing tool and one finishing tool for each wheel. The roughing tools operate automatically, being controlled by a heavy roll of perforated paper and operated by dry air of 80 lb. per sq. in. pressure which is forced through the perforations. To prepare the perforated roll it is necessary to mark the actual contour desired on one wheel, double size on a piece of drawing paper. Using a special machine, a circular disk similar to the cutting tool is moved along the line of contour, while the feed desired is stamped through the paper of the pilot roll. The finishing tool is used with hand feed to insure a light, smooth cut, and to eliminate the danger of wheel failures resulting from sharp tool ridges.

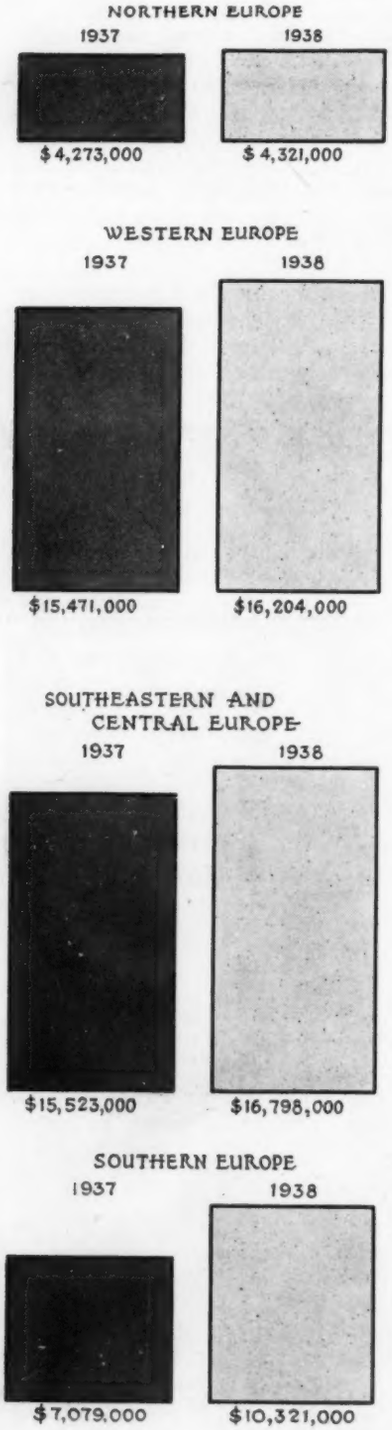
The procedure of mounting the wheels in the lathe is as follows: Taper and split sleeves are placed in the bore of each wheel; one wheel is lifted by a hoist and placed into the chuck on the faceplate at the left-hand head. The second wheel is then lifted into its chuck on the faceplate of the right-hand head; this head is moved forward by electric power until the end of the arbor enters the tapered sleeve. Finally the jaws of the chucks are adjusted to the correct position and then tightened.

The results obtained make it possible to machine each pair of wheels with a weight distribution within a limit of 8 lb. in weight and a tolerance of $\frac{1}{32}$ in. on each surface. From these limits service wheels are usually mated in sets of four with a variation in outside diameter of half a tape thickness or 0.02 in.

Machinery Key to German

By LEWIS M. LIND
Chief, Machinery Division
United States Department of Commerce

EUROPEAN PURCHASES OF GERMAN METAL-WORKING MACHINERY, 1937-1938



A HEAVY FLOW of fabricated goods into export markets is vital to German economy because the Reich needs foreign exchange with which to pay for essential imports. They must be fabricated goods because engineering skill, in the words of Karl Lange, new Director of the German Machinery Trust, is the most valuable "raw material" Germany has available within its borders today. The arts and knowledge which contribute to building machine tools and rolling mill equipment can be used in Germany to give domestic or imported raw materials, when exported, a value many times their original cost. Thus an asset existing in the Reich can be sold abroad time after time, in effect, without itself being diminished.

Last year Germany exported metal-working machinery valued at $69,636,000. This compared with exports of $72,842,000 in 1937. The decline was more than accounted for by Russia's failure to sustain purchases, which dropped from $18,301,000 in 1937 to only $2,800,000 in 1938. This sudden change in volume is characteristic of Russian trade.

Machinery is important in Germany's economic plans. Production last year amounted to 5,500,000,000 Reichsmarks, about $300,000,000 of which was for export. In 1937, when German machinery of all kinds shipped abroad totaled $320,000,000, the relative importance of the main classes was as follows:

(In Millions of Dollars)

	Value	Per Cent of Total Machinery Exports
Metal-working equipment	80.0	25.0
Textile machinery	39.1	12.1
Internal-combustion motors	26.8	8.5
Food machinery	17.2	5.2
Agricultural equipment	16.1	5.0

It is easy then to see that metal-working machinery is the spearhead of the German trade drive.

To check on claims that foreign markets for German metal-working machinery have recently undergone sweeping changes, important countries have been grouped to show significant shifts. Northern European countries were classed as one geographic bloc. Western Europe constituted a second group, since there have been rumors that these countries were shrinking as German markets. Southeastern Europe, the third area, was believed coming into greater prominence, so those countries were experimentally classed together. Latin America was the last geographic area which it seemed logical to consider as an entity.

Of $69,636,000, representing all of Germany's exports of metal-working equipment in 1938, $16,204,000 was sold to the nations of western Europe: Great Britain ($6,580,000), France ($3,433,000), Netherlands ($2,666,000), Switzerland ($2,003,000), Belgium ($1,331,000), and Ireland ($191,000). England's total was about $2,000,000 less than the year before, but French purchases, almost $700,000 higher than in 1937, made up some of the loss. A higher volume of Dutch buying and increased Swiss and Belgian purchases more than compensated for the rest of the British decline.

In Northern Europe, 1938 purchases of $4,321,000 were only $48,000 more than in 1937. A decrease of a half million dollars in Swedish imports was more than balanced by greater shipments to Finland, Denmark, Estonia, and Latvia.

Southeastern Europe is reported currently taking a much larger share of German machine tool exports than formerly. The actual situation however is as follows:

(In Thousands of Dollars)

	1937	1938
Austria	1,094	.....
Bulgaria	176	437
Czecho-slovakia	2,417	2,223
Greece	592	1,131
Hungary	1,682	1,856
Poland	2,343	5,641
Rumania	3,860	3,963
Turkey	349	675
Yugoslavia	3,010	872
	15,523	16,798

Were it not for the arbitrary inclusion of Poland in the group, the apparent increase in German sales would

Export Drive

instead have been a notable decline. Austria's incorporation into the "Greater Reich" reduced the 1938 aggregate for the above countries $1,000,000. The doubling of Greek purchases was a result of German-managed bilateral trading for Greek foodstuffs and tobacco, while the Yugoslavian reduction was apparently caused by the rise of a competitive domestic industry. So it appears that sales of German machine tools have held up much better in Western Europe than in the Southeast.

"Southern Europe" showed a remarkable rise. Italy, Spain, and Portugal imported $10,321,000 of German metal-working machinery in 1938 compared with $7,079,000 in 1937. Italian purchases were preponderant, increasing from $6,788,000 in 1937 to $7,480,000 in 1938.

Shipments of metal-working machinery from the Reich to Spain shot up from $218,000 in 1937 to $2,727,000 in 1938. The outstanding improvement in German sales was much more impressive than Spanish imports of metal-working machinery from the United States which were $2,104 in 1937 and $68,349 in 1938.

Machinery built in the Reich sold mainly on its merits in pre-depression days. The present-day German trade policy, however, exemplified by the slogan "Export or Die," had led to the forcing of foreign sales by the German Government. Mainspring of the system is allotment of export quotas to be filled by the German machine tool builder or rolling mill manufacturer if he wishes to receive raw materials which make up his product. In other words, an engine lathe maker in Cologne, with a production of $4,000,000 annually, may be told to sell up to $1,000,000 in foreign markets. If he fails, his allowance of iron, steel, or high-speed cutting metal will be reduced. If, on the other hand, he wishes to cooperate, he is given a direct export subsidy to compensate for his loss when quoting a price under that of a British or American machine tool builder. The subsidy comes from a fund to which he, his competitors and the German public (through taxes and higher domestic machine-tool prices) have contributed.

Competent authorities estimate the subsidy outlay for all German exported commodities for each of the past three years at $200,000,000 to $400,000,000. A Berlin press story a few months ago stated that the export subsidy fund for the new fiscal year was to be raised from one billion Reichsmarks ($400,000,000) to two and a half billion Reichsmarks ($1,000,000,000). Since the latter amount is a sum equal to about 40 percent of Germany's entire exports last year, doubt exists whether it will be entirely used during the twelve-month period.

On some equipment German bids have been 25 to 40 per cent less than expected. Future prospects for British and American manufacturers must be calculated with this possibility in mind.

The objective of German trade is to form an economic unit in Central Europe, of which the "Greater Reich" will be the drafting room and factory, and the countries of Southeastern Europe the granaries and kitchen gardens. Economic treaties pressed upon those small nations during the past six months tend to corroborate this theory.

Though German exports of metal-working machinery to Yugoslavia declined in 1938 from the previous year, Germany became the largest single holder of Yugoslavian securities by acquiring Prague. Germans held only 55,000,000 dinars of Yugoslavian capital early in 1938, or less than one per cent of the total Yugoslavian capital owned abroad. By annexation of Czech-owned holdings the German share was increased to 1,500,000,000 dinars, or $34,650,000.

Germany is Hungary's biggest market; and Austria, which had been Hungary's second most important customer, is now included with the Reich and will still more emphasize Hungarian dependence on Germany as a market.

Rumania, having signed the "economic treaty" with Germany, is fitting into the German plan admirably. About three-fourths of Rumania's exports consist of petroleum and its derivatives, which the Reich needs badly; and Germany has been about twice as important to Rumania in recent years, both as an export market and as a source of supply, as the next most important countries.

The German machinery industry is large, second only to that of the United States in size, number of employees, total production, and ex-

NON-EUROPEAN PURCHASES OF GERMAN METAL-WORKING MACHINERY, 1937-1938

ports. Its current rate of activity is reported to be about 98 per cent of theoretical capacity. There has been a shortage of skilled machinists in the industry.

German machine tool exports were higher in the first quarter of 1939 ($21,480,000) than in the same quarter of last year ($19,360,000). Information regarding the countries to which this equipment was sold is not yet available.

Germany's continued success depends on many imponderables. If peace continues, she is likely to expand her metal-working equipment sales to Southeast Europe, giving more attention to the "Drang Nach Osten," or "push toward the East." A development most certain to counteract this movement would be outstanding economic improvement in the other countries doing business with the Southeast European nations, thus making the latter's commercial relations with the Reich less vital.

It is unlikely any change in direction will occur in the interdependence of Germany and the smaller countries. Future variations probably will be in degree only. Geographic proximity will remain the principal factor. This might be modified by an era of world-wide prosperity and might be slowed up still further by an even more stringent lack of raw materials in the Reich. Another retarding factor would be the placing of greater emphasis by Germany on armaments at the expense of metal-working machinery for export, since machinery builders are selling at export mainly because they are told to do so. Higher profits are made on sales within the Reich.

England can be expected to resume its position as a serious competitor of Germany in European metal-working machinery markets whenever a quieter political condition allows British industry to think again of foreign trade. The United States, at this time the leading exporter of metal-working machinery, may be counted upon to challenge German foreign trade in Central and South America, Russia, Western Europe and the Far East.

Welding Cut the Repair Cost on This Job

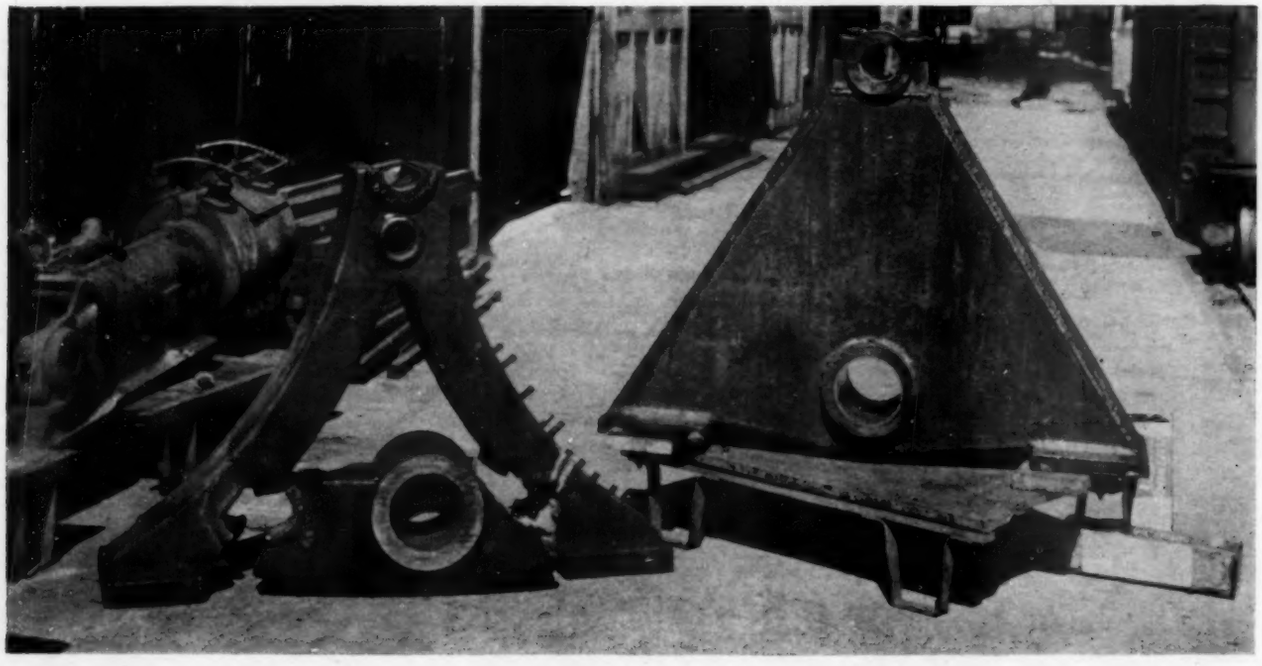
THE OLD SAYING, "There is more than one way of skinning a cat," was called to mind recently when a set of rolls 20 ft. long broke in service at the Baker Manufacturing Company, Springfield, Ill., makers of snow plows, scrapers and bulldozers. One of the end standards, which carries two large shafts on which large driving gears are mounted, broke when the rolls were overloaded and it was necessary to restore the rolls to service as quickly as possible.

Two possibilities were considered: welding the broken pieces of casting together with the electric arc or purchasing a new casting. Either method likely would have been satisfactory. The repair was finally made, however, by fabricating a new steel standard to replace the broken one.

The only difficulty was that the plant did not have facilities for machining such a large structure. The problem was solved by pre-machining the two bearings, which meant that they would have to be held to 0.015 in. when they were welded in place. Design of the new end standard was of the simplest type. It and the broken casting which it replaced are shown in the illustration.

Construction consisted of 1-in. plate throughout, with the exception of the lower main bearing which was fabricated from 1½-in. plate formed in a die designed for the purpose and welded to make a complete cylinder (which is seen in the photograph). After welding, the bearing was completely machined and the bronze insert permanently installed. The lower and upper bearings were both lined up by means of two anchor pads and welded. The welding was done in about 2 hr. by the shielded arc process using Lincoln Electric equipment.

When the unit was installed on the rolls, the bearings lined up perfectly with the shaft, indicating absence of any warpage due to welding. The cost of the new fabricated parts was 32 per cent less than by either of the other processes considered.



Keep Informed Through Toolroom Forms

Here are some simple forms that will aid in keeping tool costs in line

By CHARLES W. HARDY
Consulting Industrial Engineer

THE COST of making tools must be known in order properly to control work going through the toolroom, or to make estimates of the tool cost for work to be done in the production department. Unfortunately, in many shops estimates of tool costs are made without any real basis for the estimates; too often they are only guesses.

Tool costs are often quoted that are far out of line with actual costs when the tools are made, especially if no records are kept while tools are in process. Frequently no one is held responsible for keeping the actual costs within the estimates given.

Not only are tool costs too often out of line with estimates, but promised delivery dates frequently are passed without completion of the tools, unless a follow-up system is used to insure meeting the promised delivery date. If, when a tool order is in process, a progress report is required regularly tools usually will be delivered on time.

Among the essentials for proper cost and production control in the toolroom is some means for recording estimated and actual costs and for recording final delivery of the tool to the customer or tool crib. For these purposes a few simple forms are required. For estimating purposes, a form similar to that shown in Fig. 1 is necessary. These forms frequently can be reproduced in a mimeograph machine at little cost. In compiling the data on this form it is essential that every operation requiring tools be considered. Also, such incidentals as experiment work and contingencies must be added in to keep the estimates in line with actual costs when they are compiled.

Estimated hours for making a given tool frequently can be determined by

ESTIMATE Date Aug. 13, 1937

Item No. 1024 Description Square Compact-Design 105

No. of Oper.	Description	Hours	Mat.	Material Kind Size
	Cover			
1	Blank + Draw - Combination	100	$.25	3½ x 3½ x 018
7	Swedge	75	10	Rich L
6	Cut Edges	30	3	
14	Stamp Design 105 Drop Hammer	50	10	
5	Trim Hinge Bench Power	40	5	
29	Curl " " "	20	2	
16	Notch	25	3	
	Bottom			
1	Blank + Draw Use Cover Die	—	—	3½ x 3½ x 018
7	Swedge " " "	—	—	Rich L
6	Cut Edges " " "	—	—	
14	Stamp Design Standard No. 16	—	—	
5	Trim Hinge	40	5	
29	Curl " Use Cover Die	—	—	
	Bezel			
1	Blank	75	15	3¼ x 3½ x 016
13	Pierce	40	5	High brass
7	Bevel + Size	45	5	
	Assembly			
29	Cover + Bottom with Hinge Pin	20	2	
52	Mirror	10	1	
48	Lock Use No 807	—	—	
	4 Sets Polishing Blocks for Cov + Bottom	80	10	
	8 Sets Lacquering Stencils "	120	15	
	Experimental, Adjustments + Changes	200	25	
	Unforeseen 10%	97	14	
	Total	1067	155	
	Direct Labor & Burden @ $1.75 Hr. = $1,867.25			
	Material & Supplies 155.00			
	Cost of Stamping Nob (Outside) 175.00			
	Total 1997.25			

Fig. 1—When estimating tool costs it is essential that all of the tools required for a given job be taken into consideration. Also, allowances must be made for experimental work, adjustments, possible changes and contingencies

comparing that tool with a similar tool previously made, providing proper records have been kept. If these records are not available, the estimator must use good judgment and later check his estimates to insure against continually estimating high or low. After tool costs have been accumulated for a few months, it will be quite easy to refer to previous tools for a guide in making estimates.

Overhead or burden costs must be added to direct labor costs in order to arrive at a total estimated cost. The burden rate can be determined only

HARDY METAL SPECIALTIES INC.
TOOL & DIE ORDER

ESTIMATED HOURS 100 JOB NO. 2003

ITEM 1024 Square Compact Cover

CUSTOMER

DESCRIPTION Combination Blanking + Drawing in Standard four post Die Set

PRINT OR DRAWING NO. 102.4.1072-1 APPROVED BY C.W.K.

DATE ISSUED August 17, 37 DATE FINISHED

DIE MAKER:- STAMP THIS ORDER NO. ON BOTH PUNCH & DIE

Fig. 2—Individual orders for tools are necessary if proper cost records are to be kept. To insure proper functioning of the control system, it is essential that such orders be used

FORM NO. 128-2M-7-37 T

ISSUED 8-17-37
FINISHED

HARDY METAL SPECIALTIES INC
DIE COST

JOB No. 2003

ITEM 1024 Sqr. Compact Cover
OPERATION Pierce & Draw
CUSTOMER

SUMMARY OF COST				
ITEM	ESTIMATED		ACTUAL	
DIRECT LABOR	125	00	102	65
LABOR OVERHEAD 40%	50	00	41	06
MATERIALS & SUPPLIES	25	00	23	33
TOTAL COST	200	00	167	04

MATERIALS & SUPPLIES		QUANTITY AMOUNT	QUANTITY UNIT	PRICE	COST	
TOOL STEEL	Red Seal	20	LBS.	.37	7	40
Die Set	Purchased See P.O. #1037				15	27
GROUND FLAT STEEL			INCHES			
DRILL ROD		5	OZ.	.06		30
SCREWS		10	PCS.	.02		20
DOWEL PINS		4	PCS.	04		16
					23	33

DIRECT LABOR — ESTIMATED HOURS 100

EMP. NO. 1 HR. RATE 1.25				EMP. NO. 5 HR. RATE .70				EMP. NO. HR. RATE				EMP. NO. HR. RATE				EMP. NO. HR. RATE				TOTAL			
DATE	HOURS WK.	HOURS TOTAL	COST	DATE	HOURS WK.	HOURS TOTAL	COST	DATE	HOURS WK.	HOURS TOTAL	COST	DATE	HOURS WK.	HOURS TOTAL	COST	DATE	HOURS WK.	HOURS TOTAL	COST	DATE	HOURS WK.	HOURS TOTAL	COST
8/18	8		10.00	8/18	8		5.60													8/18	16		15.60
19	4	17	11.88	19	20	15	7.70													19	19	35	25.18
20	6	23	7.50	20	1	19	.70													20	7	42	4.38
21	5	28	6.25																	21	5	47	4.63

Fig. 4—This card is used for accumulating and summarizing the actual cost of each individual tool. When the tool finally is completed, the total actual cost of direct labor, overhead and materials can be compared with estimates

DATE 8/18/37 NAME John Smith EMP. NO. 5

JOB NO.	PART NO.	PART DESCRIPTION	O.T. HRS	HOURS ON	HOURS OFF	HOURS WK'D.	COST
2003	1024	Covers	-	8	4:30	8	5 60

HARDY METAL SPECIALTIES INC.
DAILY TIME TICKET - DIE & MAINTENANCE

Fig. 3—It sometimes is an aid in simplifying the control system if the toolmaker is instructed to list materials and supplies used on the back of his daily time ticket. Both direct labor and materials are posted daily from these reports in order to insure that the total actual cost of the tool will be recorded

after a careful study of all indirect costs affecting the toolroom. Generally, in plants in the metal products industry maintaining their own tool and die departments the burden rate will range from 25 to 50 per cent of direct labor costs, depending on size and shop conditions.

For the No. 105 square compact for which estimates are shown in Fig. 1, the estimated hours total 1,067, and a rate per hour of $1.75 has been used as the combined labor and burden cost per hour in the toolroom. Labor and overhead costs for the tools to make this compact thus are estimated to cost $1,667.25. To this must be added the estimated cost of material and supplies necessary to make the tools, as well as the cost of any work, such as die sinking and engraving, that may have to be done on contract in some other shop.

When the estimates have been approved, and authority has been obtained individual orders should be issued for each tool, die, jig or fixture required. These orders constitute the toolroom's authority to proceed with the work. A typical tool and die order form is shown in Fig. 2. This order is given to the toolmaker to whom a job is assigned and he is required to report the actual hours spent in making the tool on a daily time ticket such as that shown in Fig. 3. This ticket also can be used for tool maintenance work and for other operations in the toolroom. If the toolmaker is instructed to list on the back of this time ticket all materials and supplies used, it can be made to serve the double purpose of giving an actual record of both time and material used in making the tool.

These time tickets, turned in daily to someone in the toolroom office, are posted regularly on the tool cost record card shown in Fig. 4. Direct labor costs are recorded on the back of this form, while materials used are shown on the face. Extensions of the cost of materials and supplies should be made by the cost clerk, in order to insure that proper piece prices are used.

All labor and material is accumulated on the cost record card, Fig. 4, until the job is completed. Then the summary of cost section of the card is filled in, and the card is placed in a permanent record file.

Should the actual hours exceed those estimated, this summary will bring this condition to light, as both estimated and actual costs are shown. Both the toolroom foreman and the estimator should review these cards before they are placed in the file, in order that they may investigate any costs that appear out of line, and can keep informed regarding the efficiency of the department.

Most tools will last considerably longer than the first job for which they are used, and they should be stored in a tool crib until needed again. Each tool should be assigned a definite location on a shelf or in a bin and a locations record card, such as shown in Fig. 5, should be made up to show where each tool is kept. When it is necessary to change the regular location of a tool, the card is revised accordingly. If the tool finally is discarded, or changed to make it suitable for another part, this should be recorded on the card.

ARTICLE NO. 1024 Square Cover DIE NO. 2003
NAME OF OPERATION Blanking & Drawing #1

QUANTITY	DESCRIPTION OF TOOL OR DIE	LOCATION SEC.	LOCATION BIN.
1	Combination in Die Set with 4 Posts	E	15

RECORD COMPILED BY OTN DATE 10/18/37

HARDY METAL SPECIALTIES INC.
LOCATION INDEX TO TOOLS AND DIES

Fig. 5—Tools are easily misplaced or damaged unless they are stored between jobs in a specially arranged crib or storeroom. For convenience, and to insure against the loss of a tool, a record card should be kept to indicate the crib location assigned to that tool

Some means of recording and controlling production schedules is essential if tools are to be delivered on time. Frequently a simple bar chart indicating promised delivery date and amount of work done on the tool will enable the supervisors to bring extra pressure to bear on tools that are not being made in line with the promised date.

Some shops find that it pays to dress tools after a given amount of work rather than wait for them to dull appreciably. Tools last longer and the work is more uniform under this system.

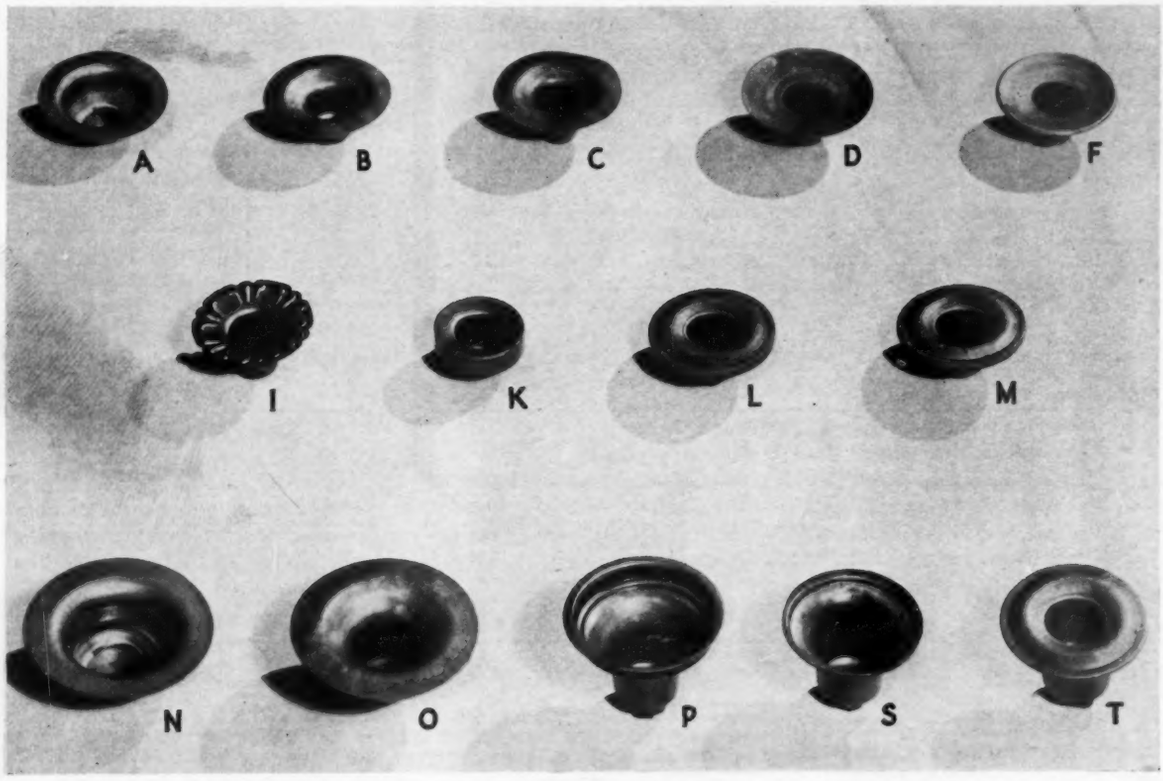


Fig. 1—Parts F, I, K, L, *and* M *are all made from shell* D, *which requires four press operations. For one style of candelabra cup, shells* L *and* S *are rolled together to make cup* T. *Shell* S *is trimmed from shell* P, *which is drawn in two operations as shown at* N *and* O

Dies for Wide-Flange Shells

Candelabra cups require an unusual set of dies because of the wide flanges involved

By MARK GOLDEN

AN UNUSUAL set of dies is used in producing the shells *F, I, K, L,* and *M* shown in Fig. 1. These five shells all are drawn in the same dies, the last operation die being different for each shell, so as to form the drawn shell *D* to the finish form desired. These different forms of shell are used as candlestick cups. A more ornate style of cup requires a supplementary set of dies for the larger shell *P*.

The dies originally were made for the shell *F* and the other forms were developed to increase the style range of the candelabra we make. The problem faced in making dies for wide flanged shells is the avoidance of draw marks on the flange. Another is to obtain the greatest height of shell without straining the metal.

In Fig. 2 is shown the first operation die for part *A*. The cutting and pressure rings for this die are made of hardened and ground tool steel. The plug over which the metal is drawn is of cold rolled steel and has an air vent through the center. Usually the angle on the plug for such a die is 45 deg., but in this case the angle was made 30 deg. This smaller angle does not strain the metal excessively and makes the second reduction easier.

The punch for this first operation die is a composite forging with a tool steel cutting edge and a machine steel back and shank. The radius on the drawing edge of this punch is $\frac{1}{4}$ in. It is this comparatively large radius which permits shell *A* to be drawn without the usual "ring" showing on the flange. The shell is made from No. 22 gage (0.025 in.) brass $3\frac{3}{8}$ in. wide. In this first operation it is drawn to a depth of $1\frac{5}{16}$ in. and a diameter of $1\frac{5}{8}$ in.

The second operation die is shown

in Fig. 3. This is the usual type of reduction die used on this kind of work, but a larger radius is used to help avoid any mark such as usually is found on reduced shells. This die reduces the diameter of the previously drawn part to $1\frac{1}{8}$ in. and increases the depth to $1\frac{3}{16}$ in. The reduction is brought down to the point where the 45 deg. angle blends into the radius of the previous draw. The shell as reduced is shown at *B* in Fig. 1.

The third operation die is similar in construction to the second operation die and therefore is not shown. In this third operation the shell is partly reduced to the 6 deg. taper that the finished shell will have. When leaving this die the shell has a diameter of $1\frac{3}{16}$ in. at the apex and its height is increased to $1\frac{3}{8}$ in. This shell is shown at *C*. It is to be noted that the height includes the angle and radius that will be used in the next operation to form the flange.

In Fig. 4 is shown the fourth operation die which finishes the shell to final shape. All parts are of tool steel except the cast iron shoe and knockout. The punch and pressure ring are hardened and ground. An angle of 10 deg. is ground on both the pressure ring and the punch. The shell as formed in this die is shown at *D* in Fig. 1 and comes out of the die without draw marks on the flange. The finishing operation on this shell is done on the trimming lathe, where the edge is cleaned up to remove irregularities. It also is beaded at the same setting; as finished it is shown at *F*. It can be used for one type of candelabra in this form, or the shell *D* can be formed differently for other candelabra.

Another type of cup made from shell *D* is shown at *I*. The irregular effect is obtained by trimming the shell *D* and then embossing the flange to suit. The type of cup shown at *K* is unusual, in that the flange is drawn downward and then curled on the edge. The die used to finish form this shell is shown in Fig. 5. In this die the flange is held under rubber pressure while the flange is being drawn downward. At the end of the stroke the knockout forms the end of the cup to the shape required for the particular candelabra being manufactured.

At *L* is shown another form of candle cup which can be formed from

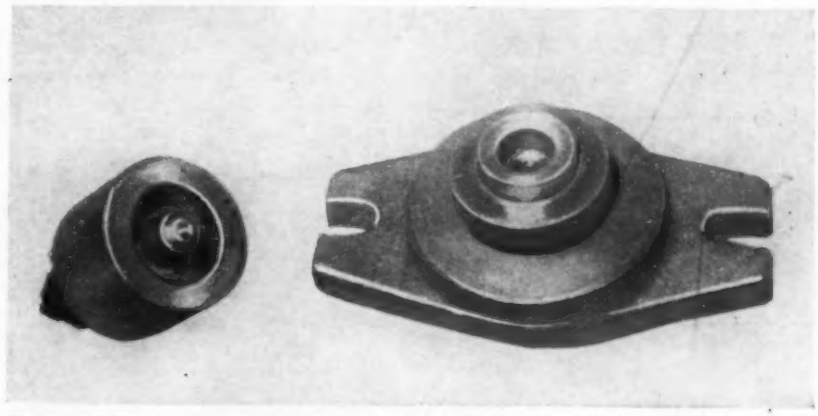


Fig. 5—The cup shown at K *in Fig. 1 is drawn in this die which holds the flange of shell* D *under rubber pressure while it is being drawn downward. At the end of the stroke the knockout forms the end of the cup as required*

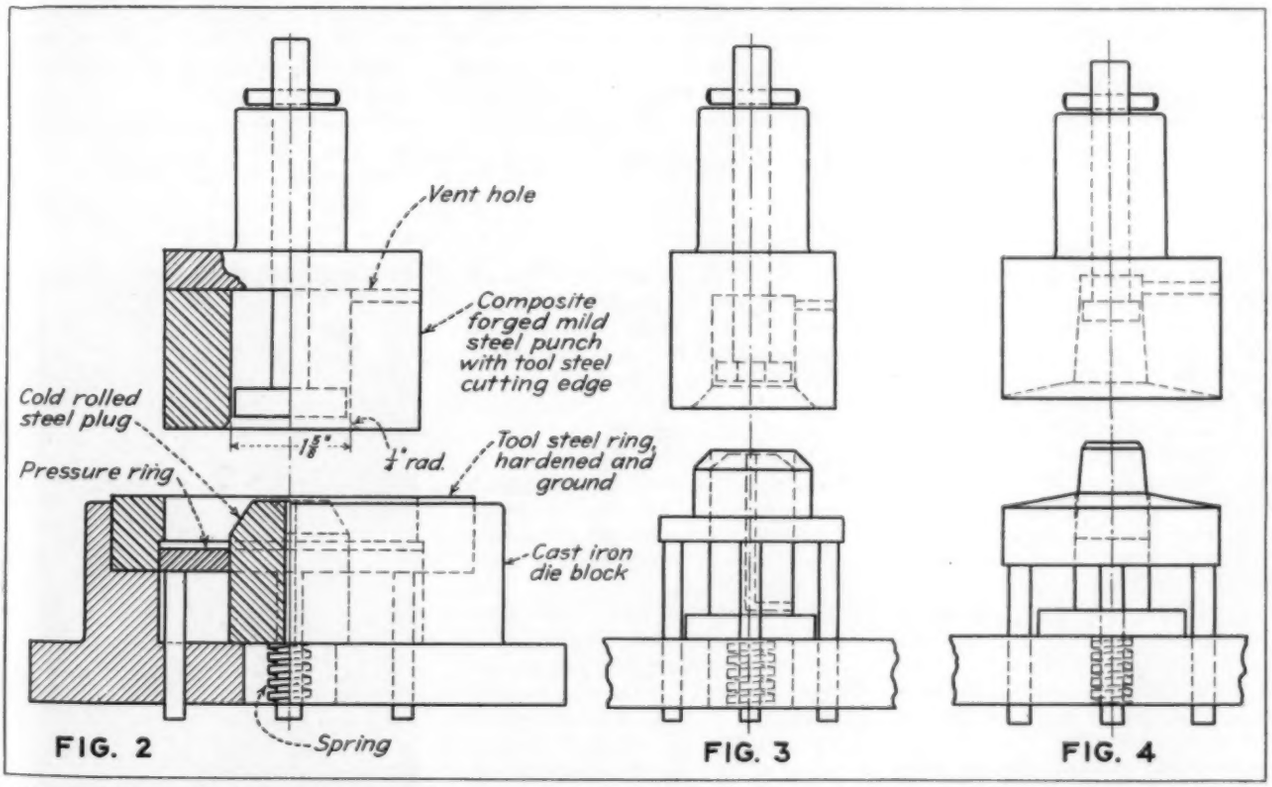


Fig. 2—This is the first operation die for drawing part A. *This part next is reduced in the die shown at Fig. 3 to form part* B, *later is redrawn to form part* C *and then is finish drawn in the die shown in Fig. 4 to form part* D. *The fourth operation die finishes shell* D *without draw marks*

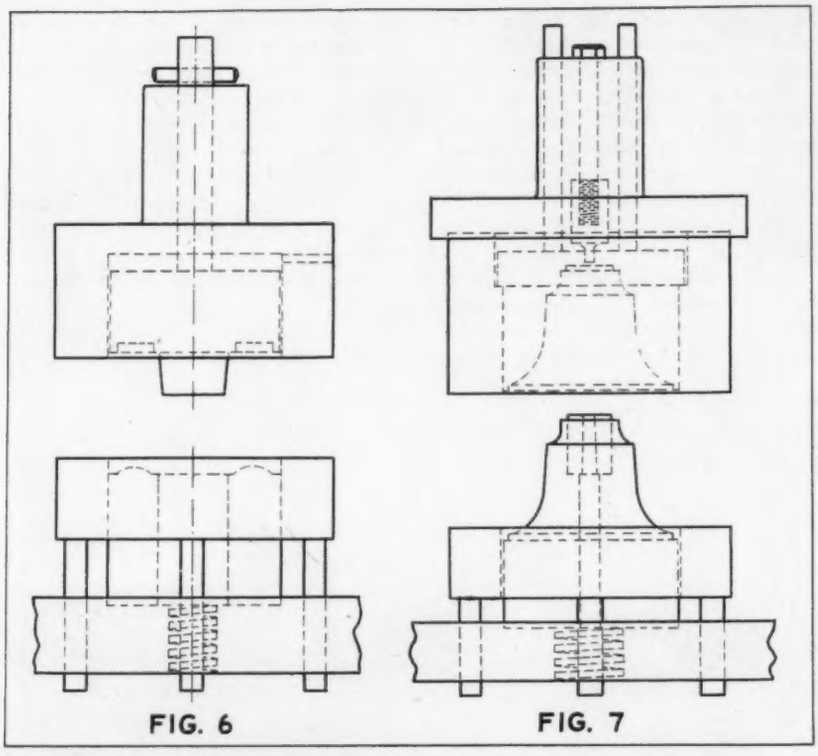


Fig. 6—This die is used for forming shell D *to the shape shown at* L. *It is somewhat similar in design to that shown in Fig. 5. Fig. 7—Shell* P *is formed in this die, which also punches a hole for an assembling screw*

shell *D*. The die used for this form is shown in Fig. 6 and is somewhat similar in design to the die shown in Fig. 5. This form of the cup is used in conjunction with the shell *S* to form the assembled unit shown at *T*.

The shell *S* is drawn in three operations. The metal used is $3\frac{1}{16}$ in. wide No. 22 gage brass. As the first two operations are similar to those used for shell D, they are not shown. However, the parts made in the first two operation dies are shown at *N* and *O*.

In the first operation the shell is drawn to a diameter of $1\frac{3}{4}$ in. and is $1\frac{3}{16}$ in. deep. The radius on the punch is $\frac{3}{8}$ in. in this case. In the second operation the shell is reduced to a diameter of $1\frac{3}{16}$ in. to a depth of $1\frac{5}{8}$ in. While the usual reduction for this type of work is 20 per cent, in this shell the reduction is 32 per cent. This is possible because of the large radius on the first operation punch and the well rounded corners on the second reduction punch.

The third, or forming die, is shown in Fig. 7. This die not only forms the shell to its finished shape but also punches a $\frac{3}{16}$-in. hole that is used for assembling purposes. The shell as it leaves the die is shown at *P* in Fig. 1.

The shells *L* and *P* are trimmed on a trimming and beading lathe, and then are assembled together on the same lathe. This assembling operation is an out-of-the-ordinary job, since the joint has to be absolutely water tight to prevent any plating solution entering the assembled shell. This later would cause discoloration at the joint. In the assembling operation the two parts of the cup are held by the chuck and tail block on the lathe and, while both are rotated at 1,000 r.p.m., a hardened steel roller is brought forward to force the extending part of the shell *L* tightly over the edge of shell *S*. When the roller is properly set an extremely tight joint is obtained.

Pot for Cleaning Metal Parts

L. H. KNAPP
Hartford Electric Light Company

Every company engaged in machining metal parts uses cleaning pots. These pots use a solution of soda or Oakite, and operate at temperatures from 190 F. up to the boiling point of water. In general, the installation consists of a boiler plate or cast iron tank, without insulation or cover, and is heated by fuel or steam. Some of them have been electrified, and tests indicate a consumption of over 1400 kw.-hrs. per month, making the heating cost so far out of line with fuel that electricity should not, in general, be recommended.

The greatest percentage of loss comes from the surface of the bath, as the solution is above the knee of the evaporation curve. If this loss can be materially reduced, the picture in regard to electric heat changes completely.

The pot shown in the photograph has inside dimensions of 30 in. in diameter, and 24 in. deep. The insulation is 2 in. thick, and the cover includes a seal to reduce heat loss. Ten kilowatts of immersion units were used (tests indicate that 5 kw. is ample) automatically controlled.

This equipment showed a consumption of 400 kw.-hrs. per month compared with a consumption of 1400 kw.-hrs. for the conventional installation. This low consumption is below the cost of fuel.

The equipment never is allowed to cool down, but is held at temperature ready to operate 24 hours a day. An important point in connection with such a pot is to make sure the cover is properly counter-weighted so it can be raised and lowered without effort, otherwise the operator may be prone to keep it open and materially increase the consumption.

Swaging and Coining

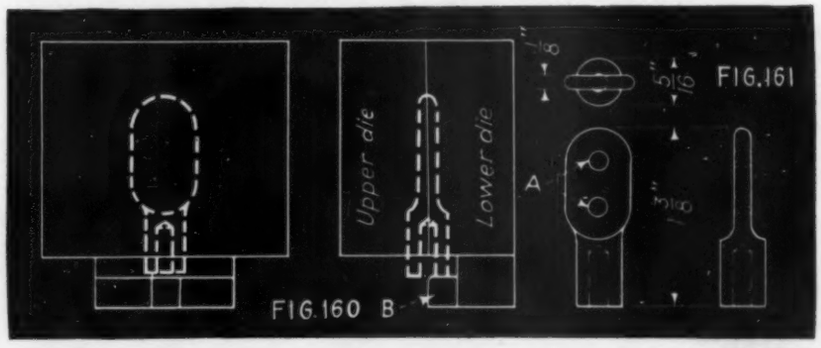
These operations, as well as cold sizing and extruding, induce displacement of material by plastic flow and consequently require extreme pressures

By C. W. HINMAN
Tool Engineer
Kobzy Tool & Electric Mfg. Company

HIGH PRESSURES are required for such operations as swaging, coining, extruding and cold sizing. Die bodies must be above average size and must be constructed of high-strength materials to resist the stresses set up. Either knuckle-joint or hydraulic presses are needed, according to the work size and the time interval allowed for the operation. Knuckle-joint presses inherently have short powerful strokes but do not provide the extra dwell at the bottom of the stroke, which is available in the hydraulic type. Therefore, the latter may be used for work having deep extrusions or for large cold sizing or pressing jobs, where the extra dwell can be utilized to put a definite set in the work. Swaged and cold-sized parts are highly compressed. Consequently, the metal becomes harder, more dense, and the resistance to wear may be increased as much as 80 per cent over machined parts.

Types of swaging dies are: (1) progressive swage and cut off; (2) swaging parts with a peripherical "draft" for hand removal of the work; (3) swaging with an overflow flange which is subsequently trimmed; and (4) confined swaging, or coining, in which the part is completed from a blank having exactly the same volume as the finished piece. In the last two, a positive ejector is necessary to lift the work from the die in connection with ram ascent.

The simplest swaging operation is to flatten a space on small annealed rods at a first station, and then to cut off to length at a second station. But progressive swaging dies are unreliable for producing accurate work with pierced holes, because swaging lengthens the stock. In all swaging and cold-sizing dies it is important to provide positive stops, or spacing blocks, between the upper and lower dies. These positive stops establish the lowest point in ram descent and determine the thickness of finished work.



Figs. 160–161—To release work from the dies, the swaged portion of the soft copper terminal has a curved edge to obtain "draft"

Before designing the press tool, it is best to make experimental swaging dies and to try them between planish blocks in a press. This test will determine whether the proposed operation is practical. In Fig. 160, a pair of die blocks is shown for producing the soft copper terminal in Fig. 161. The blank is prepared by drilling one end and cutting to length. After swaging to shape, the holes *A* are pierced in another tool placed next to the swaging die. Stop *B* locates the blank endwise in the lower die.

Swaging With Overflow

Swaging with properly designed tools is probably the best method for producing small intricate parts. Many difficult designs of work are impossible to produce except by swaging. A case in point is the steel gear, Fig. 162, shown as it came from the overflow swaging die, Fig. 163.

The flange, or web, *B* behind the

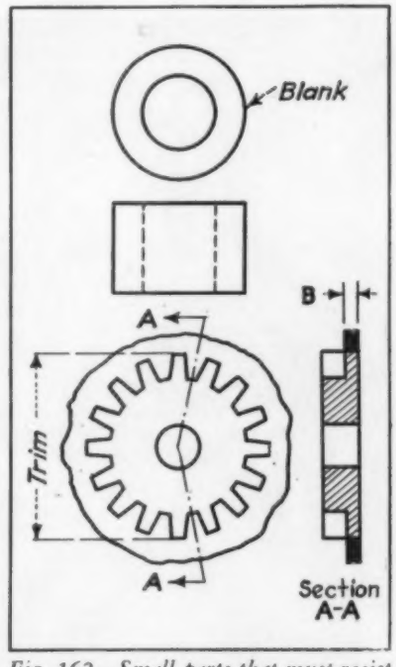


Fig. 162—Small parts that must resist wear, such as this business-machine gear with the integral flange behind the teeth, are swaged by the overflow process

gear is integral with the teeth. Flange thickness is determined by the overflow space *B* between the closed dies. The flange is subsequently trimmed in a second-operation die; trimming coincides with the outside diameter of the gear. The part could be trimmed larger in diameter, if the over-flow flange were swaged greater in area. It could be trimmed with a higher step of teeth, producing a cluster gear. These variations indicate the possibilities in the design of swaged parts.

A typical die layout for swaging and ejecting small work is shown in Fig. 163. The "dead soft" steel blank has a diameter slightly less than the root diameter of the gear teeth. The hole diameter is an easy fit over the vertical center stud in the lower die. Height of the blank is determined by the volume of material needed to swage the piece, and is easily found by experimental blocks during the initial trials.

The lower die opening is of internal gear shape, and is broached and lapped to size. Shedder *C* is a sliding fit within the lower die; it registers in the die shoe at the closed height of the tool, and at sufficient depth for swaging the thickness of the gear teeth. The tool is operated in a 200-ton knuckle-joint press, which is several times the necessary capacity to swage the piece.

When the press is open, the hole in the blank is placed over the vertical stud in the lower die. In descent, the ram squeezes the blank between the upper and lower dies until plastic flow begins. Continuing the squeeze, the metal is forced to "flow" into all the interstices of the die. The hole in the blank closes tightly around the central pin, the gear teeth are formed, and the tooth thickness is determined by the registration of the shedder in the die shoe. Surplus metal overflows into space *B*.

Work ejection occurs near the top of the ram ascent. Heads of screws *D* contact the bottoms of hollow adjusting nuts *E*. The screws are attached to the ejector bar and elevate it as the ram ascends. When the shedder is flush with the lower die face, the work is ejected. The center pin is slightly tapered towards its point to aid ejection. All interior surfaces of the dies are smoothly polished.

Swaging dies cannot be used until thoroughly cleaned with gasoline and perfectly dry. If a small portion of oil remains in the die it will explode when attempting to swage, and this

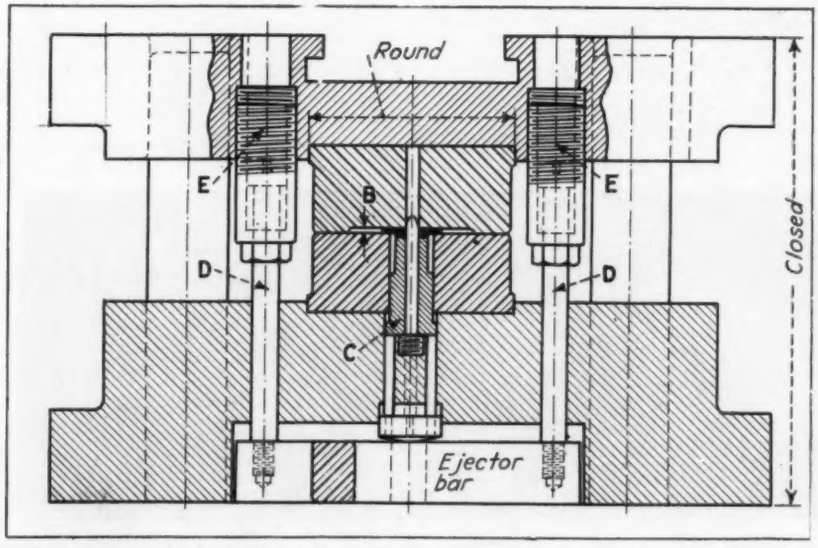


Fig. 163—Tooth thickness of the swaged gear is determined by the registration of the shedder C in the die shoe

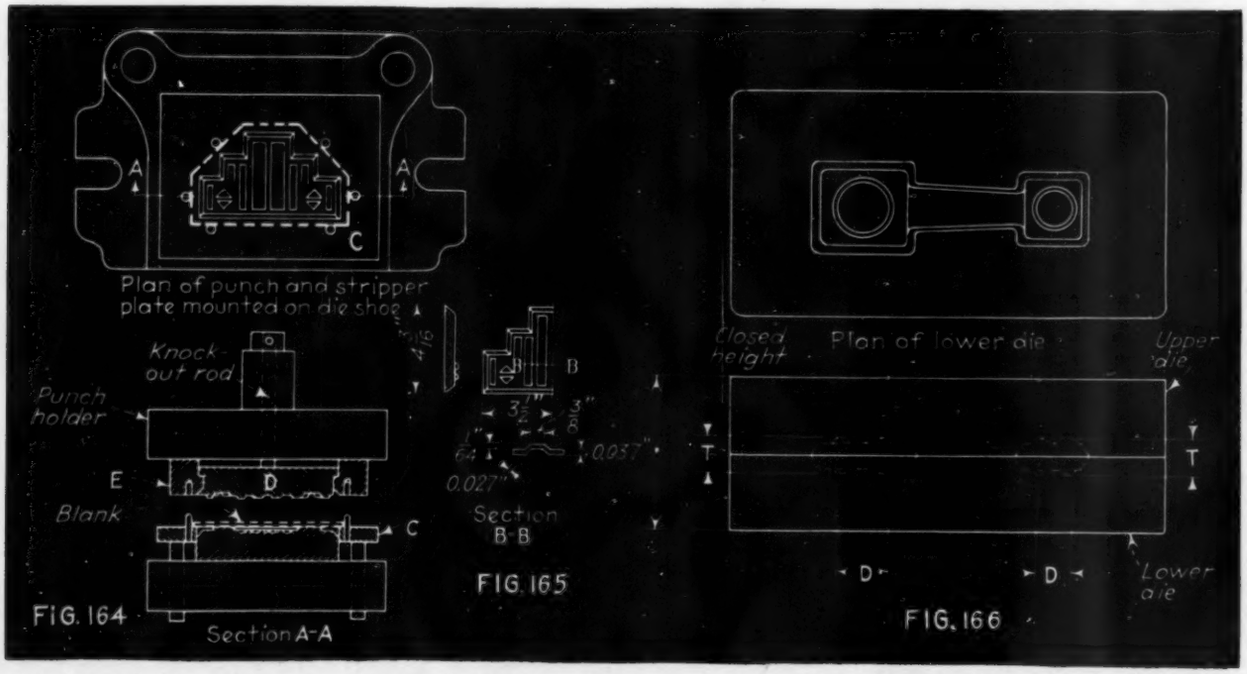


Fig. 164—Shedder D also acts as the coining punch in this inverted tool, which forms, draws and coins an escutcheon plate. Fig. 165—Sides of the raised portions of the plate are squeezed thinner than the rest of the part in order to provide the metal needed to coin sharp corners. Fig. 166—Forged bosses are relieved to prevent "pyramiding" the pressure toward the center, which may interfere with coining and be responsible for a slight hump at the center

may fracture some part of the tool.

Coining is a high-tonnage operation. Under hundreds of tons pressure, the die forces metal by plastic flow into various embossed designs of raised panels, beads, depressions, ornamental outlines and sharp corners. Coining dies not only include the mintage of money, medals, medallions and jewelry parts, but also the forming and embossing of buttons, locks, ornamental hardware, designation plates and escutcheons.

A die in which the coining principle predominates is represented by Fig. 164. The operation consists of drawing, forming and coining the ornamental escutcheon plate, one-half of which is shown in Fig. 165. The die is an inverted type to secure easy delivery of the finished piece by the action of a vertical knock-out rod.

The punch is surrounded by the stripper pad *C*, upon which the blank is located within a nest of pins. The pad is operated by the large vertical pins that rest on a heavy spring-plate in the bolster. The upper coining punch is shedder *D*, and it is a sliding fit within the outer drawing and forming die *E*. The shedder is backed by coiled springs, and in addition is operated by a knock-out rod. When the ram ascends, after completing the operation, spring-pad *C* follows and raises the finished work from the lower punch. The work adheres within die *E*, which carries it up to a point where the knock-out rod depresses the shedder and delivers the piece.

The operation requires a pressure of 150 tons. This apparently excessive tonnage is necessary for coining sharp edges along the raised portions of the work, a section of which is shown at *B—B* in Fig. 165. The metal is squeezed thinner on the sides of the raised portions, and these sides are the source of extra metal for producing sharp corners.

Twelve right-angled beveled corners in the outline are *drawn*, while the straight sides between the corners are being formed down. The attached flange around the work perimeter is subsequently removed in a second-operation trimming die.

Cold Sizing

In recent years, someone discovered that bosses could be cold sized by pressing as well as by machining, if the pressures were heavy enough. Fig. 166 shows the die blocks and the principle used in cold sizing four bosses on a forged-steel connecting rod. To avoid using excessive pressures the dies were relieved, and a "draft" is provided along all edges of the work that are not squeezed to size. There is also a 45-deg. draft around the bosses to be sized, to facilitate removal of the finished work.

The closed height of the dies is checked by the surfaces of the blocks. These surfaces are in a plane coinciding with the longitudinal center plane of the work. Areas of the stop surfaces should be large enough to withstand three times the yield strength of the metal being sized. The check determines the thickness to be sized, or dimension *T*. Bosses *D* are also squeezed to size.

Certain heavy-gage sheet-metal blanks are cold sized to produce uniformly rounded edges, planished surfaces, and for other corrective purposes. Small work to be sized in thickness is usually milled about $\frac{1}{32}$ in. oversize, and larger work to half this amount. The dies used are similar in principle to the one described under Fig. 166 and descend to a sizing-stop either on the die surfaces or spacer blocks. It is good practice to select a knuckle-joint press having a factor of safety of three or more over the maximum work pressure.

A practical determination of the necessary pressure for cold sizing is to squeeze the first pieces with the dies placed in a hydraulic press provided with tonnage gages. The mathematical computation depends on

$$P = (A \times S)/2000$$

in which *P* is the pressure required in tons, *A* the area to be sized in square inches, and *S* the ultimate compressive strength of the work material per square inch.

The tools and process for the cold extruding of soft aluminum shells, compared with drawing them, are relatively simple. Fig. 167 illustrates the die principle for extruding an aluminum blank and producing a shell. The punch is shown in three of its operating positions. At *A*, the blank has been placed on knock-out pad *D* in the bottom of the die, while the punch is up. At *B*, the punch in descent has forced the metal into a plastic state and caused it to rise and fill the space between the punch and die.

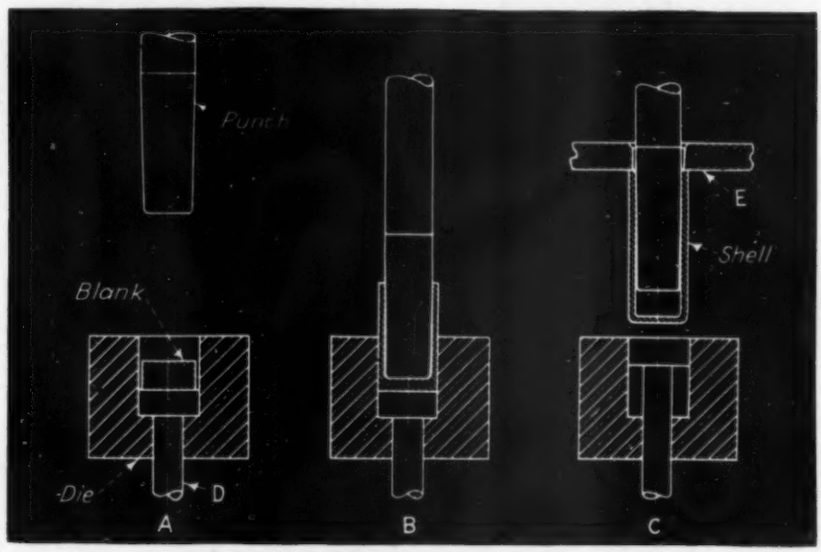


Fig. 167—In extruding aluminum, the blank is laid in the die recess and the metal squirts up around the punch to form a shell

At *C*, the punch is carrying up the finished shell, followed by the knock-out pad. The knock-out pad is operated by a cam underneath the press, as described previously under Fig. 34 (*AM*—Vol. 82, page 969). The shell is stripped from the punch by contact under the positive plate *E*. The entering end of the punch is slightly smaller in diameter than across its top to facilitate stripping. Shells are removed from the press by a jet of air.

Blank thickness and length of press stroke control the shell height. The limit is approximately seven times the shell diameter, depending of course on the diameter and ductility of the material. The thickness at the closed end of shells is determined by the depth the punch enters the die, while the shape of the closed end is determined by the cross-section design of the tool members. The cross-section contour of the shell body can be any desired shape, if made uniform throughout its length.

Part 26 of Mr. Hinman's series will appear in an early number.

IDEAS FROM PRACTICAL MEN

Squaring the Shanks of Small Taps and Reamers

By HERBERT M. DARLING
Superintendent, Wells Tool Company

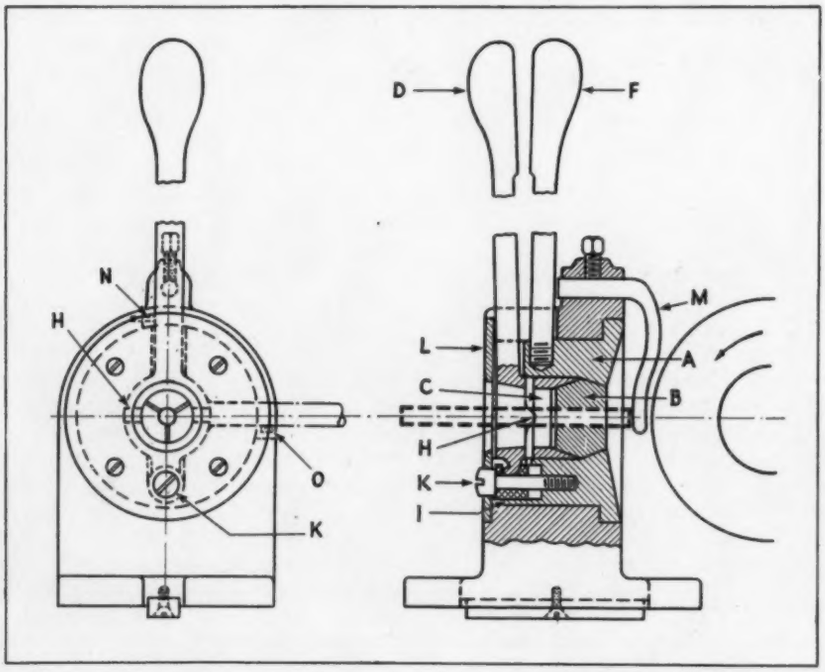
The fixture illustrated is for milling the squares on the shanks of small taps and reamers. The body is bored to receive the spindle *A*, in which is fitted the spring chuck *B*. The chuck is operated by end movement of the hardened sleeve *C* which is actuated by lever *D*. Lever *F* is screwed into the back end of the spindle. When both levers are grasped and lever *D* is squeezed toward lever *F*, the projection *H* on lever *D* forces sleeve *C* forward and closes the chuck on the work. Lever *D* is fulcrumed by a hook-shaped projection at its lower end engaging a slot in the adjusting sleeve *I* which is adjusted by the screw *K* the head of which projects through a hole in the retaining collar *L* which is attached to the rear end of the spindle.

Adjustment of sleeve *I* regulates the grip of the chuck on the work, which is entered from the rear and rests against the adjustable stop *M*. Milling is done by a pair of straddle cutters, milling two opposite flats at one pass. Stop *M* is thin enough for the cutters to straddle it in passing. Chucks of various sizes up to $\frac{3}{8}$ in. capacity are included in the equipment. At the start, the levers *D* and *F* are in the upright position, lever *F* being in contact with the stop *N*. The work is indexed by rotating the levers 90 deg. in the vertical plane, bringing lever *F* into contact with stop *O*. The fixture is mounted on the table of a hand miller having a pedal-operated feed and a weight return.

In use, the operator grasps levers *D* and *F* with his left hand and inserts a blank through the chuck and against stop *M* with his right hand and squeezes lever *D* toward lever *F*, closing the chuck on the work. He then feeds the table forward by depressing the pedal, causing the cutters to mill two opposite flats on the work. Lifting his foot from the pedal, the table is returned to the starting point by the weight. He indexes the work by rotating the levers 90 deg. in the vertical plane, lever *F* coming to rest against stop *O*. The table is again moved forward by depressing the pedal, causing the other two opposite flats to be milled.

While milling proceeds, the operator picks up a blank between the thumb and first finger of his right hand, ready for insertion. When the piece being milled is finished and the table has returned to starting position he releases his grip on the levers, removes the finished piece, gripping it between the first and second fingers, and inserts the blank he is holding. He then grasps both levers, depresses the pedal and repeats the former operations.

Production depends greatly upon the dexterity of the operator. The average production is about 375 pieces per hr., although a fast operator will produce 500 pieces per hr. One very agile operator has milled the squares on the shanks of 1,800 $\frac{1}{4}$-in. taps in three hours.



Average operators have milled the squares on 375 to 500 small tap shanks per hour in this fixture, the lever of which is used to chuck and index the work

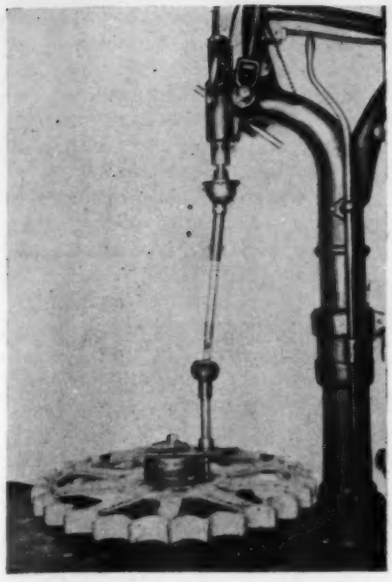
Increasing the Capacity of a Drill Press

By EDWIN KILBURN
Kilburn's Machine Shop

Repair work in a jobbing shop must often be done in equipment that is too small for the job. How the job of reboring and counterboring worn bolt holes in a sprocket of a caterpillar-type tractor was done in a drill press that was too small for the job is shown in the illustration.

As the work was quite heavy it was set up on the base of the drill press, the gear to which the sprocket was to be attached being underneath. Since the sprocket was too large in diameter to be centered under the spindle of the drill press, the boring bar had to be driven by an offset connection, which in this case consisted of two universal joints salvaged from wrecked automobiles and connected by a shaft of the proper length.

The upper universal joint was provided with a taper shank to fit the drill-press spindle and the lower joint was fitted to the top of the



Since the sprocket was too large in diameter to be centered under the drill press spindle, the boring bar was driven through universal joints

boring bar which was squared to fit the square hole in the joint. A bolt through a cross-hole in both parts held them together when in use and its removal permitted raising the joint from the bar when changing from one hole to another. The upper end of the boring bar was guided by a bushing held in a clamp on the hub of the sprocket, while the lower end was guided by the holes in the gear hub.

One good feature of the device is that several holes could be reached without changing the position of the set-up, which is quite an advantage on heavy work.

Power Checks on Motors Spot Trouble

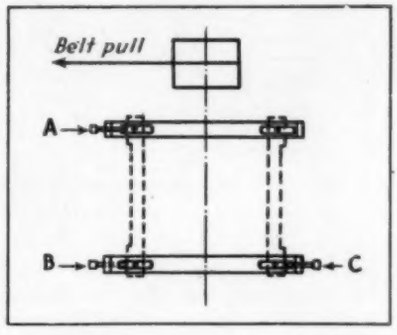
By K. B. HUMPHREY

A power survey taken on individual motors throughout a plant will often bring to light troubles outside of the motors themselves. While an overloaded motor may indicate some electrical trouble, in many cases the trouble will be found in the transmission system. In plants where group drives are used, machines may be added to the group without due notice to the electrical department. A periodic survey may often spot conditions that will eventually cause trouble. One cause of excessive power use is the misalignment of shafts. Sometimes, especially in plants that have been in operation for a number of years, parts of the buildings may have gradually settled, throwing the shafts out of line and causing an excessive load on the motors. Where no periodic power tests are made, trouble may have run a long time before being discovered, or perhaps it may have started before power surveys were instituted.

In one case the motor driving a machine through a belt was found to be overloaded. It was discovered that the machine had settled on its timber foundation while the pedestal that bore one end of the countershaft had not settled, thus putting an extra load on the motor.

In another case a periodic survey showed that a 30-hp. motor was taking more power than ever before. A careful check showed nothing wrong electrically. The trouble was found to be caused by a slight settling of the frame building which threw the shafting out of alignment.

Where a machine is driven from a motor by a horizontal belt, the motor is usually mounted on a base having two screws for adjustment to take up any undue slack in the belt. The screws, *A* and *B*, are both on the same



In a machine driven by a horizontal belt, one of the adjusting screws in the base is generally in the wrong place

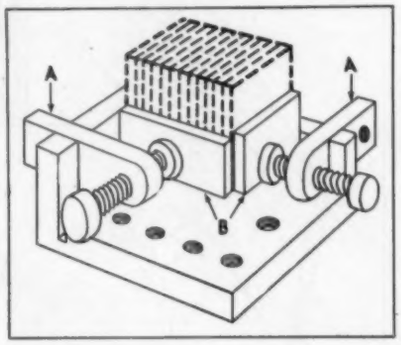
end of the base, as shown in the sketch. In adjusting the motor in a direction to tighten the belt, it is evident that the tendency of the belt pull will be to cause the motor to pivot about the end of screw *A* as a center, and that screw *B* will be of no use whatever. Therefore it is obvious that a screw should be placed at *C* instead of at *B* to correct that condition. It will then be possible not only to tighten the belt, but to align the motor with the shaft of the machine it is driving.

When periodical surveys are made, a careful check of mechanical conditions should be made at the same time because any increase in consumption of power may indicate something wrong in the drive.

Angle Block for Clamping Plates or Disks

By CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

Shop men may find much use for the clamping type of angle block illustrated. The clamping bars *A* are a sliding fit in the milled slots in the



This device is very convenient for clamping plates or disks that are stacked either horizontally or vertically. It aligns the work quickly and accurately

upturned edges of the block and can be used either singly or doubly. They are provided with clamping screws, the inner ends of which bear on the pads *B*. Blocks of this type are very convenient for stack-clamping plates or disks, aligning them quickly and accurately. Screws can be run in the tapped holes in the base of the block for attaching strap clamps to secure work that is stacked in flat tiers.

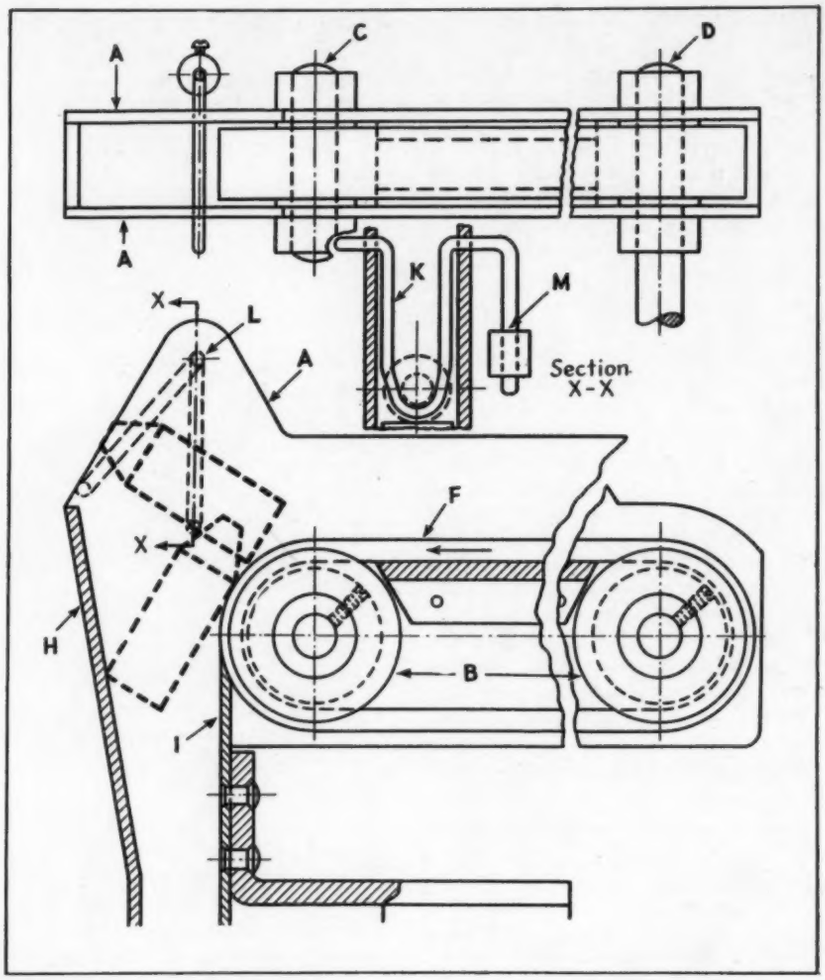
Simple Turnover Mechanism

By JOHN A. HONEGGER

One of the problems in designing automatic feeding devices is to develop simple means for definitely prepositioning work so that it will drop into a chute in the correct position for delivery to the processing part of the equipment.

A case in point is the turnover device illustrated, which is employed in the delivery into a chute of cylindrical parts having a taper at one end, it being essential that they drop into the chute with the straight end first.

Between the two side plates *A*, the pulleys *B* are mounted on shafts *C* and *D*, shaft *D* being the driver. Around the pulleys runs the V-trough belt *F*, under the top strand of which is a support to prevent it from sagging. At *H* and *I*, front and back plates are welded to the side plates to



If the wrong end of the work is presented to the chute, this device turns it over so it will fall into the chute correctly

form a rectangular chute for the work to drop into. At *K* a heavy wire is bent into U-shape to form a yoke of which the ends are supported in holes *L* in the side plates. One of the ends is bent downward and the weight *M* is attached to it.

In operation, the belt carries the work from the previous operation toward the mouth of the chute. Normally, the yoke is held in the vertical position by the weight. If the work comes into contact with the yoke with the straight end first, it merely pushes the yoke away and falls into the chute with the straight end downward. If, however, the tapered end of the work should present itself to the mouth of the chute, the smallest part of the taper will slide into the yoke until the larger part of the taper contacts it. Then any additional force exerted by the belt will cause the work to push the yoke away until its straight end is over the mouth of the chute. Thus, the work supported at the tapered end by the yoke is unbalanced and will fall straight end downward into the chute. The weight will then bring the yoke into its normal vertical position, ready to be pushed away by the straight end of an advancing part, or to pick up the tapered end and repeat the turnover.

Cams for Automatic Screw Machines

By WALTER G. PORTER
General Manager, Porter Machine Company

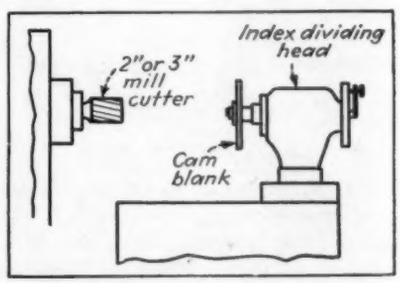
In an article entitled "Involute Plate Cams" (*AM*—Vol. 83, page 206) the writer discussed one method of laying out constant-rise cam curves on plate cams for automatic screw machines. The present article covers another method of making cams that are not limited to the constant-rise type, but deals with all types, such as harmonic, constant acceleration, constant acceleration-decelerating, and so forth.

Naturally, in generating cams by milling, high-priced and complicated dividing heads and gearing are required to cover the range of all types of curves. It is well known that milling is the best and most accurate method of generating cams, although it is very expensive, especially in the set-up of special equipment.

The writer has had occasion to experiment with another method where cams can be milled without the need for gearing the dividing head to the table feed. By laying off on the drawing board the cam curve it is desired to generate, and by figuring the various distances a point will move as it travels along the curve, intervals of 1-deg. steps can be mathematically figured from the axis about which the cam is to rotate. By giving the milling machine operator the table of figures as the point progresses from one degree line to another, he can mount the blank in the simple dividing head illustrated and proceed as follows:

The blank is milled into with a small fishtail cutter, locating the starting point and its distance from the cam center. Then it is milled into with a 2- or 3-in. end mill. Indexing the dividing head for 1 deg. and elevating the table the correct difference in cam rise, the blank is again milled with the end mill. These operations are repeated until the curve has been completed.

It can readily be seen that, due to the large diameter of the end mill and the very small spaces between cuts, when the cam is turned through its total angle of action the resulting curve will be almost smooth except for very small ridges between where the various cuts were made. These small "humps" can be removed by draw filing and, with a minimum amount of care, a resultant cam curve can be produced that is within 0.001 in. of error in contour.



Curves of plate cams for automatic screw machines can easily be milled with the illustrated cutter and indexing head

It is to be understood that the end mill enters the blank endwise, the same as in drilling.

Metal-Spraying Technique—I

Courtesy of the Metallizing Engineering Company

SUCCESSFUL metallizing depends upon the use of proper equipment, including an individual air compressor, a compressed air cleaning and drying unit, and an air-control unit. Compressed air from a shop line should never be used, because it usually contains excessive amounts of moisture and oil.

The size of the compressor required depends upon the number of guns to be operated, and whether or not the compressor is to be used for grit or sand blasting. A previously published table (*AM*—Vol. 83, page 576) gives the airflow and horsepower requirements for single-stage compression required for different weights of sand or grit used.

In calculating air-pressure requirements, allowance should be made for losses in piping and connections. The line pressure at the air regulator should be at least 10 lb. per sq.in. higher than that required for actual spraying.

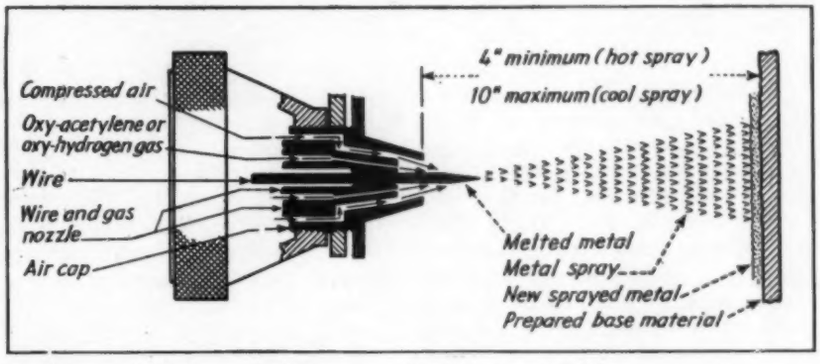
The compressor unloader should be set so that the difference between the cut-out and cut-in pressures is a minimum, preferably not more than 10 to 15 lb. Poor air regulation will give fluctuating air pressures at the metallizing gun, and will result in rough coatings as well as in reduced spraying speed.

The consumption of flame-producing gases depends on the metal being sprayed. Acetylene, hydrogen or propane consumption per gun varies from 22 to 32 cu.ft. per hr. Oxygen consumption varies from 48 to 52 cu.ft. per hr.

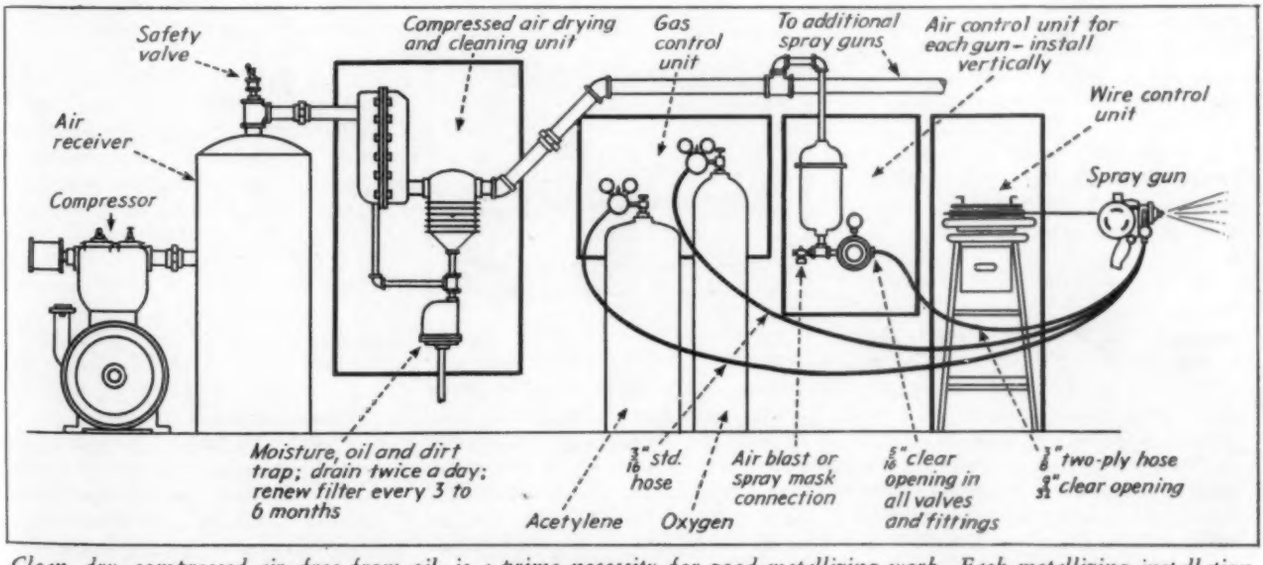
The most common sizes of wire (or rods) used are $\frac{1}{8}$ in. and No. 11 Brown & Sharpe gage. Spraying data for different types of wire are given in the accompanying table.

The fineness of the sprayed coating varies to some degree with the speed of spraying. The speeds shown in the accompanying table may be used without loss of fineness. Above these speeds, the coatings lose fineness gradually as the speed is increased, depending on the metal being sprayed.

The metallizing process should not be used on applications where the sprayed metal will be subjected to sharp impact, continued pounding at one point, or severe edge strain. However, it is satisfactory for use on bearing surfaces where there is considerable vibration, especially if there is full bearing contact.



At the nozzle of the metallizing gun, the wire is melted by oxy-acetylene, oxy-hydrogen, or oxy-propane flame, atomized by a compressed air blast, and sprayed out in the form of finely divided molten or semi-molten particles. Upon reaching the surface to be coated, the particles chill almost instantly and key themselves into the crevices of the surface, effecting a mechanical bond


Safety valve
Compressed air drying and cleaning unit
Gas control unit
To additional spray guns
Air control unit for each gun – install vertically
Wire control unit
Spray gun
Air receiver
Compressor
Moisture, oil and dirt trap; drain twice a day; renew filter every 3 to 6 months
3/16" std. hose
Air blast or spray mask connection
5/16" clear opening in all valves and fittings
3/8" two-ply hose 9/32" clear opening
Acetylene
Oxygen

Clean, dry, compressed air, free from oil, is a prime necessity for good metallizing work. Each metallizing installation should be complete as shown in this drawing. It is frequently advisable to install an exhaust hood over the spray gun

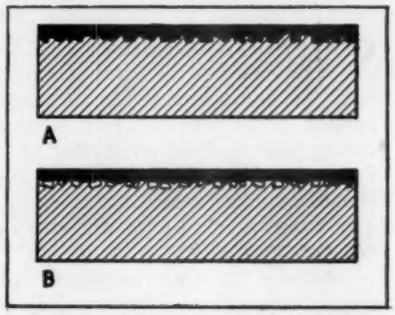
Metal-Spraying Technique—I

METALLIZING DATA FOR ACETYLENE

"Metco" metals*	Wire size	Wire speed, ft. per min.**	Extension of wire beyond air cap, in.	Pressure, lb. per sq. in.		
				Acetylene	Oxygen	Air
Aluminum	⅛ in.	7.5	¼	15	16.0	55
Babbitt	⅛ in.	12.2	¼	12	13.0	60
Brass	11 B&S	9.6	¼	15	16.5	55
Bronze, A and C	11 B&S	7.4	¼	15	16.5	55
Bronze, M. and T	11 B&S	10.0	¼	15	16.5	55
Bronze, P	11 B&S	8.6	¼	15	16.5	55
Cadmium	⅛ in.	12.2	¼	13	13.5	60
Copper	11 B&S	7.6	⅜	15	16.5	60
Iron	11 B&S	5.1	⅜	15	17.0	60
Lead	⅛ in.	12.2	⅝	12	13.0	60
Monel	11 B&S	4.7	¼	15	16.5	60
Nickel	11 B&S	3.9	¼	15	17.0	60
Solder	⅛ in.	12.2	⅝	12	13.0	60
Steel, Nos. 10 and 25	11 B&S	5.1	⅜	15	17.0	60
Steel, No. 40	11 B&S	5.2	⅜	15	17.0	60
Steel, Nos. 80 and 120	11 B&S	5.3	⅜	15	17.0	60
Tin	⅛ in.	12.2	¼	12	13.0	60
Zinc	⅛ in.	12.2	⅜	15	16.5	60

* These metals are drawn to specified temper and hardness, and coiled to definite diameters, in order to obtain maximum metallizing efficiency.

** Higher speeds, with fine coatings may be obtained for production spraying of soft metals by using special gears for the spray gun.



Section A shows how a bond is obtained between the sand or grit blasted surface and the sprayed coating. Section B shows how poor atomization of the sprayed metal allows it to bridge over the keys and openings made by blasting; a poor bond is the result

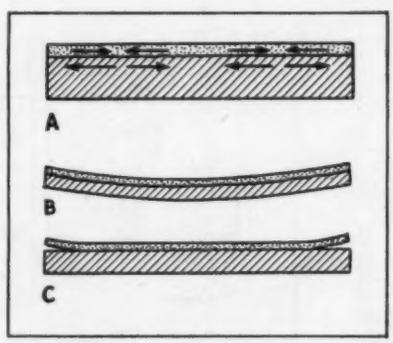
The elapsed time between surface preparation and spraying should be held to a minimum. When the base material is metal it should be sprayed before oxides or other forms of corrosion form on the surface. Extra care must be used with iron and steel; they will oxidize readily in damp atmospheres and should be sprayed within two or three hours after preparation. However, if the atmosphere is dry 24 hours delay in spraying will not materially affect the bond.

The heat generated by the spraying operation has considerable effect on the bond. When the first layer of metal is applied, it has a higher temperature than the base metal. When additional layers are applied, each in turn has a higher temperature than the preceding one; consequently, as each successive layer cools and contracts, stresses are set up which increase the bond on outside shaft diameters and decrease the bond on inside shaft diameters and on flat surfaces.

To minimize the effect of cooling stresses on inside diameters and flat surfaces, they should be kept as cool as possible during the spraying operation. This can be done by applying only 0.002 to 0.004 in. of metal per coating, and allowing each coating to cool before applying another one. Before applying each succeeding coat, the metal already sprayed should be sufficiently cool so that the back of the hand can be placed on it without discomfort. Compressed air played on the surface opposite that being sprayed is recommended.

In spraying outside diameters, while heat stresses increase the bond they sometimes result in longitudinal cracks in the coating. Therefore, the shaft should not be overheated, this being especially true when spraying steels with a high carbon content. A cool spray may be obtained by increasing the distance between the gun and the object being sprayed.

Shafts should be sprayed in a lathe, with the spraying gun mounted on the tool post. Shafts 2 in. in diameter or under should be turned at a surface speed of approximately 35 ft. per min. and the feed should be ⅛ in. per revolution. For shafts larger than 2 in. diameter, the surface speeds should be 50 ft. per min., and the feed should be ⅛ in. per revolution. Faster speeds and feeds will result in applying a lighter coat; conversely, decreasing the surface speed and carriage feed will give a heavier coating. Speeds can be varied to accommodate individual jobs.



When sprayed metal cools, a tensile stress is set up in the coating as indicated by the arrows in A, *resulting in a compressive stress in the base material. These stresses tend to deform the base material, as shown at* B, *or weaken the bond, as shown at* C, *allowing the sprayed metal to break away from the base material*

When spraying inside diameters, the coating should never be applied with one pass of the gun. Best results are usually obtained with a surface speed of 75 ft. per min. and a carriage feed of ⅛ in. per revolution.

Practically all flat surfaces are sprayed by hand and demand considerable skill on the operator's part. When spraying large areas, the correct thickness of coat is obtained by applying a given weight of metal per square foot. In order to do this, the operator should measure off a given area, for example, 100 sq. ft., determine the weight of metal required for each square foot and then weigh out the amount of metal required for the 100 sq. ft. area. To obtain the correct thickness of coat, he must apply that amount of metal to the area as evenly as possible. One coat should be applied horizontally over the entire surface followed by alternate coats sprayed vertically and horizontally. The thickness of the coating can be measured accurately with an electric thickness gage.

"—Death and Taxes"

REMEMBER the old expression, "As certain as death and taxes?"

Medical experts today are hard at work in efforts to ward off death as long as possible. But what is being done to ward off increased taxes? Precious little!

Look at the record. And what a record! Last year you and I and every other American paid to the federal, state and local governments directly or indirectly 22 cents out of every dollar received. That's the highest taxes ever paid in U. S. history. And the end isn't in sight!

What taxation has done to business is shown by a study of 163 corporations made by the American Federation of Investors. Those companies last year turned over to tax collectors 62 per cent of the earnings remaining after other expenses had been met. Taxes equaled $283 for each holder of common stock and $576 for each employee.

The sum spent for the support of government is almost beyond human comprehension. For every second that the clock ticked all day and night long 365 days during 1938, governments in the United States spent $26,065.

These expenditures obviously cannot be lopped off too drastically overnight without having an adverse effect on the national economy. A patient constantly doped for seven years cannot suddenly have the stimulant cut off without having a violent reaction.

Even an elementary school child, on the other hand, can figure out that if you keep paying out more than you take in, eventually you will be standing on the street with a tin cup in your hand, dark glasses on, and a sign "Blind" around your neck. And surely you must be blind if you couldn't have foreseen such results.

The House at Washington made a heartening move toward curtailing expenditures last week when it unexpectedly rejected the President's spend-lend program. But the country still is floundering without any plan for balancing its income and its outgo, or for paying off billions of debts contracted in recent years or for deflating instead of inflating government outlays.

Our system of taxation needs to be put under the microscope. Before that is done, however, a close examination should be made of government expenses to determine what is essential and what isn't. When we have arrived at some fair measure of what government should cost, then we should revise our tax structure onto a sound basis.

You can hasten the day when this will be done by keeping in touch with your representatives in Congress, in the State legislatures and in local city councils. Tell them your views, describe to them your problems as a citizen and as a business man. I shall miss a bet if you don't find them ready listeners and subject to the constructive influence of sound facts and figures.

Burnham Finney

GAGING BUSINESS

Metal-working activity continues to increase, with still greater Fall business in sight. National defense program purchases are a major source of orders.

Metal-working companies, which in the aggregate constitute almost one-fourth of all American industry, are in a period of expanding operations. Production is gaining as the summer progresses and should be even better in the fall. The current prosperity is largely traceable to export buying and to the national defense program. The volume of business purely from private sources is still disappointing, though it is slowly growing.

MACHINE TOOLS—Orders have continued to pour into the industry at a high rate. Much of the business is for export, especially to France and England. A British airplane maker has bought a large amount of equipment in this country. Russia too is in the market again, having contracted for a sizable volume of machinery for munitions production. Other Soviet orders are expected. Japanese orders, for which releases are scheduled late this month or in September, have not been speeded up by notice of termination of the U. S.-Japan trade agreement. Huge foreign purchases of machine tools are pending, insuring further strong support for the industry this month and next.

Domestic orders are dependent mainly on the aircraft industry and on the government's defense program. Business is coming not only from big airplane and aircraft engine makers, but also from scores of small companies with parts contracts. The navy has made important purchases, particularly of planers and other heavy machines for its yards, the awards including $323,600 to William Sellers & Co. Automotive tool bookings have been relatively light. A prominent domestic dealer reports having sold more machine tools in July than in any previous month this year.

AIRCRAFT—Orders this year may reach $300,000,000 for the industry. Pacific Coast plane makers alone have backlogs totaling $103,000,000, and the U. S. Army is to spend $100,000,000 on new planes soon. Bids. are now in on single-engine and observation planes for the Air Corps. The aircraft boom, partly attributable to British and French buying, has benefited scores of parts and accessories companies as well as plane builders themselves. The federal government has placed orders running into the millions for aircraft parts the past two weeks. Grummon Aircraft has been awarded a navy contract for planes and parts amounting to $1,786,860. Ford Motor is tooling for manufacture of an aircraft motor in France. Fairchild Engine & Airplane Corp., in conjunction with Haskelite Corp., is preparing to build planes having molded plastic fuselages and wings.

SHIPBUILDING — Operations are being rapidly accelerated as companies are swamped with new business. Federal Shipbuilding and Bethlehem will each build a light cruiser, Newport News an aircraft carrier and New York Shipbuilding a repair ship at a total cost of $93,639,000. Extent to which shipyards are busy on commercial ships is indicated by the news that the U. S. Maritime Commission now has 66 ships under construction.

STEEL—The operating rate stays around 60 per cent, with a good chance it may go higher on the strength of automotive tonnage for initial manufacture of 1940 models. Structural steel needs are slightly less, but tin plate output is brisk. Export orders are continuing to mount in volume.

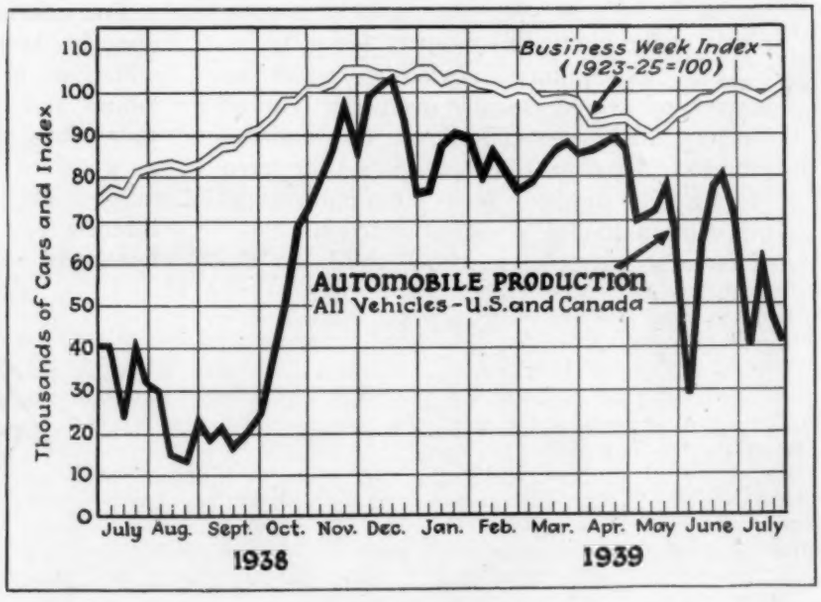
AUTOMOBILES—Settlement of the General Motors strike brightens prospects for a big production season this fall. Both Ford and Chevrolet had unexpectedly large retail sales during July, a development which augurs well for the success of most of the 1940 cars.

INDUSTRIAL TRUCKS — Automatic Transportation Co. has received from the Russian government an order for 78 electrical industrial lift trucks and 156 industrial batteries valued at $250,000. This is said to be the largest single order placed in this industry since World war days.

ELECTRICAL EQUIPMENT—Business is on the upgrade. Electric appliance output is running well ahead of last year's volume. Electric utility companies in the far west are spending 40 per cent more money this year on new equipment than in 1938. Sperry Gyroscope and General Electric have been awarded War Department contracts for anti-aircraft searchlights for $1,562,000 and $1,230,240 respectively.

AUTOMOBILE PRODUCTION VS. GENERAL BUSINESS

Automobile production has held up much better this year than last, despite earlier shutdowns to tool up for new models



NEWS OF THE INDUSTRY

Canadian Munitions Output Reaches New High Due to Britain's Empire Defense Activities

English Contracts Overshadow Those of Dominion; Aircraft Orders Outstanding

MONTREAL—Output of war supplies in the Dominion is being rapidly expanded to a new peacetime high. A delegation of Canadian industrialists now in London expects to bring home shortly more orders connected with Britain's rearmament program.

Business now at hand falls into two classes: that placed by the English government and that contracted for by the Canadian government. Important British orders being produced are bombing planes valued at $10,000,000 by Canadian Associated Aircraft, Ltd., a central company acting for five manufacturers; shell parts by National Steel Car Corp. and Dominion Steel & Forgings; steel by Dominion Steel & Coal Corp. (about 35 per cent of its output); 40 Hawker Hurricane planes by Canadian Car & Foundry; explosives by Canadian Industries, Ltd.; and 5,000 machine guns by John Inglis Co.

Canadian government business consists mainly of 7,000 machine guns being built by the Inglis company; searchlights valued at $2,000,000 being made by Canadian General Electric Co.; rifles, gas masks and other equipment for the militia being built at government arsenals in Ontario and Quebec.

Assured of continued British orders for some years, Aluminum Co. of Canada is spending $7,000,000 on plant expansion, part of it at Kingston, Ont., for a plant to make aluminum aircraft parts. Steel Co. of Canada is reported in line for important British contracts for steel products. Future British orders are likely to be for tank parts, lighter armaments, shells and aircraft. Textile companies, such as Dominion Textile and Canadian Celanese, hope to get orders for parachute fabric and airplane textures.

Confusion over the Canadian government's armament policy has largely been cleared up. The plan being followed is to place business with Canadian private firms under close supervision of a Defense Purchasing Board located in Ottawa and headed temporarily by R. C. Vaughan, vice-president Canadian National Railways. The board is responsible for all contracts in excess of $5,000. Companies awarded non-competitive contracts involving secret specifications where bids are not asked will be limited to a profit of five per cent.

British business thus far has been placed direct with Canadian companies from London. The British War Office has been supplied by the Canadian government, in cooperation with private companies, with information regarding productive facilities. All companies making up Canadian Associated Aircraft are rushing work on parts for the new British bombers, and construction of two new assembly plants for these bombers is being speeded. The first planes will be flown to England late this year.

Orders placed by Canada will supplement those of Britain, which is willing to give business to Canadian firms also getting orders from the Canadian government with a view to developing in Canada an industry capable of large-scale expansion in event of war. It is expected that most of Canada's armament business, however, will be handled by a few big companies, such as National Steel Car, Canadian Car and Canadian Vickers. These companies have ample idle plant capacity. There is plenty of idle labor too and the country is believed relatively free from air attack.

Basic policy of Canadian defense is fortification of the Pacific Coast prior to the Atlantic, development of an air force ahead of the navy and the navy in advance of the militia, and reequipping the militia as soon as resources permit. The 1939–40 defense budget totals $60,000,000.

ANOTHER MACHINE TOOL SHOW WILL BE HELD IN CLEVELAND

CLEVELAND—An exhibit of metalworking equipment consisting of machine tools, small tools and accessories will be held in the Cleveland Central Armory concurrently with the Machine Tool Show, October 4-13. Companies participating in this exhibit will be those who have not been able to secure space at the Machine Tool Show scheduled for the Cleveland Auditorium. Grob Brothers, Grafton, Wis., has leased the armory and is sponsoring the exhibit. Richard C. Bonner, P. O. Box 12, Grafton, Wis., is exhibition manager. The armory contains 13,000 sq. ft. of floor area. A number of companies already have taken space.

Bigger Bite—*Latest advance in American air defense is the perfection of a four-bladed controllable-pitch propeller, shown above installed on a Curtiss P-36A pursuit ship. Developed by Curtiss Propeller Div. of Curtiss-Wright Corp., it absorbs greater power for a given diameter, permitting installation of more powerful engines without increasing landing gear length. Its use on multi-engined planes will reduce weight by allowing closer engine spacing*

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

Over two billion dollars voted for military supplies and expenses during current session of Congress. Aviation expansion measures constitute an important part of legislation.

WASHINGTON—With a baleful eye cocked over both oceans, President Roosevelt led a majority of the public in a rising defense dander which in turn moved Congress to appropriate a peacetime record of over $2,000,000,000 for war supplies and vast military expansion, especially on the sea and in the air. About $1,800,000,000 was allocated directly to the Services, while the balance went for quasi-military works. Even with no more future expansion, maintenance of the bigger war machine will greatly increase the yearly demand on the metal-working industry.

While Congress supported the President's defense policy 100 per cent, it refused to go any further than preparedness. Mr. Roosevelt wanted to tell the dictators a thing or two in their own language, but Congress shushed him after his speech guaranteeing the integrity of Canada. And in the end Congress balked the President's demand for repeal of the "neutrality" law which as it stands will prevent the sale of American munitions to the Democracies if they have to fight.

More Planes for Army and Navy

Army expansion was the first big item in the session's program. The legislation authorized a maximum of 6,000 serviceable planes for the Air Corps, and appropriations totaling $300,000,000; $170,000,000 for aviation set in motion procurement to bring Air Corps to 5,500–6,000 units; $10,000,000 for airplane ordnance; millions to double the air personnel; a total of $53,069,760 for expansion of defense at Panama; $34,500,000 for educational orders authorized but only about half appropriated. War Department has $961,000,000 to spend in fiscal 1940.

Regular Army Supply, 1940, totals $548,995,812. Air Corps got the biggest slice: $74,220,637, which includes about $1,000,000 for research; Ordnance department got $30,420,711; Signal Service $4,878,836—all three figures include contract authority. The six arsenals got $6,000,000 for modernization by replacement of machine tools.

Naval expansion last year was the "billion dollar" ship construction act; this year's expansion took the form of far-flung distribution in both oceans of twelve new air bases at a cost of about $66,000,000. Guam was thrown off the list because it stuck out too far East and would have needled the Oriental situation.

Navy supply, 1940, was $773,049,151, the largest peacetime outlay in history, $142,876,047 more than last year; new ship construction and authorization of aircraft expansion to 3,000 accounts for 63 per cent of the increase; balance is collateral personnel and other increases; $88,298,000 goes to Naval aviation; $270,000,000 is for ship replacements; two 45,000-ton battleships; two cruisers; eight destroyers; eight submarines; two seaplane tenders; one repair ship. Total: 23 vessels, cost in all $369,606,000 (balance over this year's fund will be in future appropriations). Three 35,000-ton ships are under construction; materials are being collected for three others and for the two 45,000-tonners. Navy may ask two more 45's in 1941.

Navy Public Works appropriation totaled $55,000,000, including $3,000,000 for facilities at Paris, Island; $1,800,000 for Philadelphia aircraft factory; $8,485,000 for construction of graving dock at Pearl Harbor; $4,000,000 for purchase of Hunters Point Drydock or an alternative; $6,000,000 for a new drydock; $2,500,000 for ship repair facilities at South Boston Drydock.

Orders for Industry

Educational orders for six critical items were placed in 1939 at a cost of $2,000,000, in the Military Appropriations Act, and $14,250,000 was authorized for 1940 by the Supplemental Act, instead of $32,500,000 for two years as originally proposed. Circular specifications which had been prepared on basis of the big appropriation were delayed when the amount was cut down.

Modernization of battleships Tennessee, California, Colorado, Maryland, and West Virginia was authorized at a cost of about $2,000,000 each with a new appropriation of $6,600,000 and funds previously authorized. Over-age vessels will be kept in commission even after new "expansion" vessels join the fleet. Modernized ships are often more formidable than when new.

Critical weapons for the protective force, including anti-aircraft guns, anti-tank guns, gasmasks, ammunition, rifles, artillery, were provided for in cash appropriations and contract authority totaling about $110,000,000.

Arsenal machinery to replace obsolete equipment in the six arsenals is being purchased with $6,000,000 appropriated for a two-year program. Increased efficiency, not greater capacity, is the object. This is the initial step in a $16,000,000 modernization program that has already been outlined.

Aircraft procurement would have been opened to negotiation in lieu of bidding if Congress had not turned down a request by the War Department aimed to permit small companies to enter the military field. Argument was that there is no other way to compensate small firms for development of expensive sample planes. In a compromise bill Congress permitted War and Navy to accept the *three* low bidders.

Additional Items Considered

Seacoast defense got $8,000,000 to be spent for guns and works at Panama, Hawaii, and along coasts.

Strategic materials, such as aluminum, chromium, antimony, mica, optical glass, rubber, tin—17 in all will be purchased during next four years under an authorization of $100,000,000.

Aviation research was appropriated $10,000,000 in the third deficiency bill to be spent by National Advisory Committee for Aeronautics for a new laboratory in addition to the one at Langley, Va. Appropriation for a plant at Sunnyvale was rejected twice in political maneuvering between California and Virginia.

Coast Guard got $25,003,210 for 1940, including three new cutters, and fifteen seaplanes with a range of not less than 2,000 miles. Proposed Alaskan air base was rejected.

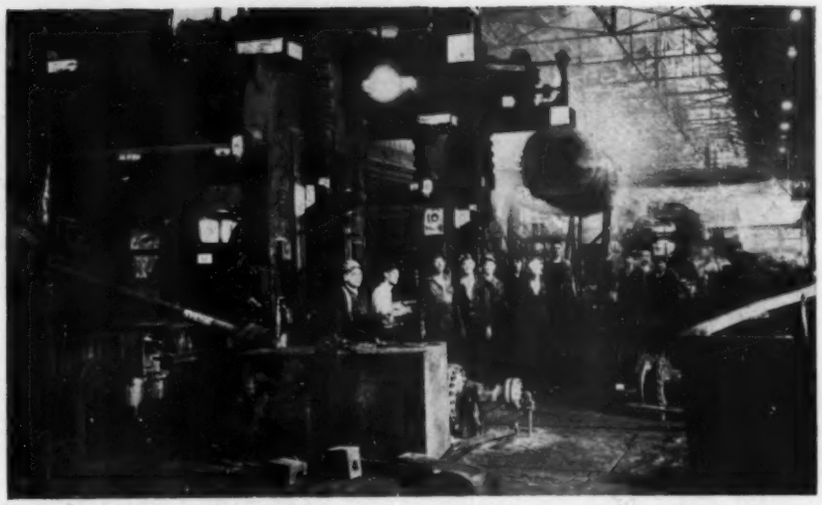
Pilot training was expanded in two ways: Civil Aeronautics Authority got $3,000,000 with which to contract with commercial instructors for training students at 200 colleges. The appropriation was cut three times, starting at $10,000,000. . . . Army contracted with civil aviation schools to give basic training to 2,100 cadets at a cost, from funds on hand, of $3,528,360. Both C.A.A. and Army initiated mechanic training programs.

Airport expansion got no direct *appropriation* as a result of a Civil Aeronautics recommendation to Congress. Federal Works Administration may contribute to extension and new construction.

Merchant Marine will continue to build at the average rate of 50 ships a year; Maritime Commission got $100,000,000 cash and $235,000,000 additional contractual backing. Sixty-six vessels are now contracted or building; seven have been launched.

MAY MAKE PLANES FOR FRANCE

MONTREAL—Eugene Schneider, head of the French armament firm Schneider-Creusot, has arrived at Montreal on a "fishing trip" and was met at the dock by J. A. Simard, president Marine Industries, Ltd. For more than a year negotiations are said to have been in progress between these two companies whereby the latter would manufacture planes for the French and perhaps become legally affiliated with Schneider-Creusot, giving that concern a secondary manufacturing source in Canada. France is reported seeking to establish a $50,000,000 credit in Canada for purchase of war materials. Production of airplane motors will be the next big move in the Canadian aircraft industry.



Time Out—*Nearing completion is the $4,500,000 modernization program of the American Rolling Mill Company's East Works in Middletown, Ohio. All men in mills shut down for reconstruction were given work on the job.*

U. S. Government Contracts Awarded to Metal-Working Firms

(Last-minute items on page 612b)

Contractor	Gov't Agency	Commodity	Amount
American Brass Co., Waterbury, Conn	War, Ordnance	Cartridge cups, bands	$49,530
Allis-Chalmers Mfg. Co., Milwaukee, Wis	Agriculture	Tractors	53,090
International Harvester Co., Milwaukee, Wis.	Agriculture	Tractors	39,344
Monarch Machine Tool Co., Sidney, Ohio	War, Air Corps	Lathes	20,599
A. B. Farquhar Co., York, Pa	War, Ordnance	Hydraulic press	20,610
National Acme Co., Cleveland, Ohio	War, Ordnance	Spindle machine	14,647
Ex-Cell-O Corp., Detroit, Mich	War, Ordnance	Shell turning machine	26,849
R. Hoe & Co., New York, N. Y	Treasury	Printing presses	184,200
Harris-Seybold-Potter Co., Cleveland, Ohio	Treasury	Perforating machines, printing presses	168,375
Lakeside Bridge & Steel Co., Milwaukee, Wis.	Navy,	Cranes	266,000
Orton Crane & Shovel Co., Chicago, Ill	Navy,	Cranes	165,630
Victor R. Browning & Co., Willoughby, Ohio.	Navy,	Crane	74,900
Struthers Wells-Titusville Corp., Titusville, Pa	Navy, S. & A	Windlass, capstans	93,842
Proctor & Schwartz, Inc., Philadelphia, Pa	Treasury	Drying units	87,630
Graybar Electric Co., New York, N. Y	War, Signal Corps	Radios	710,477
Douglas Aircraft Co., El Segundo, Calif	War, Air Corps	Airplanes	14,470,082
North American Aviation, Inc., Inglewood, Calif	War, Air Corps	Airplanes	1,659,090
Bethlehem Steel Co., Bethlehem, Pa	Navy, S. & A	Forgings	180,120
U. S. Pipe & Foundry Co., Philadelphia, Pa.	Panama Canal	Pipe	125,419
Gisholt Machine Co., Madison, Wis	Navy, S. & A	Turret lathes	48,127
Warner & Swasey Co., Cleveland, Ohio	Navy, S. & A	Turret lathes	22,526
Kingsbury Machine Tool Corp., Keene, N. H.	War, Ordnance	Drilling machines, tables	23,867
H. R Krueger & Co., Detroit, Mich	War, Ordnance	Milling machine	17,000
Seneca Falls Machine Co., Seneca Falls, N. Y.	War, Ordnance	Lathe	10,415
G. A. Gray Co., Cincinnati, Ohio	Navy, S. & A	Milling machine	41,961
American Tool Works Co., Cincinnati, Ohio.	Navy, A. & A	Engine lathe	50,167
Pratt & Whitney Div., Niles-Bement-Pont Co., Hartford, Conn	War, Ordnance	Shaper, boring mill	28,972
Heald Machinery Co., Worcester, Mass	War, Ordnance	Grinders	15,022
Brown & Sharpe Mfg. Co., Providence, R. I.	War, Ordnance	Screw machines	85,204
Sundstrand Machine Tool Co., Rockford, Ill., Barnes Drill Co., Rockford, Ill., Gallmeyer & Livingston Co., Grand Rapids, Mich	War, Ordnance	Honing, lapping, polishing machines	100,770
Cleveland Automatic Machine Co., Cleveland, Ohio	War, Ordnance	Screw machines	23,862
Jones & Lamson Machine Co., Springfield, Vt.	War, Ordnance	Turret lathes, grinder	63,540
Kearney & Trecker Corp., Milwaukee, Wis.	War, Ordnance	Milling machines	61,138
Wm. Sellers & Co., Philadelphia, Pa	Navy, S. & A	Boring, drilling machines	93,339
Leach Co., Oshkosh, Wis	War, Signal Corps	Reel units	227,812
Stromberg-Carlson Mfg. Co., Rochester, N.Y.	War, Signal Corps	Switchboards	273,220
Kellogg Switchboard & Supply Co., Chicago, Ill	War, Signal Corps	Telephone equipment	148,620
United Aircraft Corp., E. Hartford, Conn	Navy, S. & A	Engines, propellers	750,891
Bendix Aviation Corp., South Bend, Ind	Phila. Aircft. Fac	Carburetor parts	75,000
Kirk & Blum Mfg. Co., Cincinnati, Ohio	War, Q.M.C	Ranges	225,179
Consolidated Steel Corp., Los Angeles, Calif.	War, Engineer	Slide gates	97,000
Blaw-Knox Co., Pittsburgh, Pa	Civil Aero. Auth	Antenna towers	179,900
Bethlehem Steel Export Corp., New York, N. Y	Panama Canal	Raft parts	786,880
Scovill Mfg. Co., Waterbury, Conn	War, Ordnance	Cartridge cups	35,250
Wright Aeronautical Corp., Paterson, N. J.	Navy, S. & A	Engines	371,269
Federal Shipbuilding & Dry Dock Co., Kearny, N. J	Navy	Light cruisers	24,452,000
Bethlehem Steel Co., Quincy, Mass	Navy	Light cruisers	23,390,000
Newport News Shipbuilding & Dry Dock Co., Newport News, Va	Navy	Aircraft carrier	31,800,000
Luders Marine Const. Co., Stamford, Conn.	Navy, S. & A	Sub-chaser hull	194,139
Mitchell Camera Corp., W. Hollywood, Calif	War, Signal Corps	Theodolite and parts	109,426

JAP MACHINE TOOL SHORTAGE TO STIMULATE BUYING IN U. S.

TOKYO—Machinery importers are reported to have on hand a two years' backlog of orders 70 per cent of which are to be filled by American manufacturers. However, they have been restricted by difficulty in securing import licenses.

Even for manufacture of products most urgently needed by the government, only about one-third of the required machine tools are available in Japan. Native machine tool builders are booked years ahead and in many cases cannot accept further orders. Japan's goal of self-sufficiency in machine tools, not to mention automobiles and airplanes, will not soon be realized.

If foreign machinery makers would do business on a credit basis, sales possibilities in Japan would be immeasurably better. Only United Engineering & Foundry Co. has transacted a major deal on a credit basis, investing some $5,000,000 of rolling mill equipment from its Wooster, Ohio, plant in the Shibaura Engineering Works.

Import applications now on file are mostly for turret lathes, grinders, and milling machines in the order named. In the first six months of 1939 Japan invested $670,000,000 in new industrial enterprises or in expansion of existing ones. Investments in the machinery industry jumped in twelve months from $2,800,000 to $83,000,000.

Latest plans are: Manchuria Machine Tool Co. will be established at Mukden to supply machine tools for North China (capitalization 20,000,000 yen); Ebara Machine Mfg. Co. will double its capitalization to 20,000,000 yen, of which 8,000,000 yen will be invested in a new machine tool plant.

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

C.I.O. generally conceded to have gained little from the General Motors Strike, while the possibility of a more serious conflict this fall has been minimized.

DETROIT—Settlement of the General Motors Strike is believed to have netted the U.A.W.-C.I.O. group little. The union boasts that it has taught the corporation a lesson, that the company finally recognizes the impotence of the Homer Martin-A.F.L. group, that the corporation has granted sole bargaining rights to it in 41 out of 59 plants, and that favorable wage readjustments have been made.

But unofficial company spokesmen tell a different story. They say that the union didn't get a thing except double-time for Sundays (and will workers work on Sunday anyway?) and that the union rank and file has been bilked by its officers even worse than in the recent Briggs strike. The C.I.O. shop committees in the 41 plants named have been the only groups heretofore negotiating with the management in collective bargaining, so where is the victory? One thing seems assured—chances of a strike of G. M. production workers this fall have been reduced to a minimum.

General Motors realized that real concessions to the tool and die workers would only add fuel to the flames when demands of production workers are later advanced by the C.I.O. So the corporation has steadily whittled down the demands of the C.I.O. negotiators, although painfully aware that its original two-weeks' advantage over Chrysler in tooling up for '40 production has been lost and that its competitor is rapidly forging ahead. All General Motors divisions have had to suspend tooling-up operations and press previews of new models have temporarily been cancelled.

Strategy vs. Strength

The U.A.W.-C.I.O. strategy was clever—to wait until it could tie up the corporation's activities indefinitely by calling out the men engaged in making tools for the various car divisions. Even the lack of a few tools would prevent production lines from starting up on '40 models. Such a strike is comparatively cheap—only 8,000 men were involved.

No secret was made of the C.I.O.'s intentions, since a report was published (*AM*—Vol. 83, page 444e) a month ahead of the actual calling of the strike on July 6. The union leadership privately wanted a supplementary agreement with General Motors, to pave the way for larger demands in the fall. The ten-cent-an-hour pay raise for tool, die and maintenance workers was put into the demands as a sop to picket-line marchers.

Only Slight Concessions Made

The supplementary-agreement idea was soon knocked out by General Motors negotiators, the ten-cent-an-hour pay raise was rejected on the ground that the wage rates were already the highest in the industry, the demand for the union label on all tools and dies made or purchased by the corporation was likewise thrown out, and the only concessions made were to higher overtime rates.

The corporation knew that surrender on any important point in the tool and die workers' demands would be the signal for production workers to get behind future C.I.O. attacks. It knew that such demands would be made in the fall just when the plants are going full tilt to fill dealers' orders. True its operations have been crippled for a month, but it made over $100,000,000 in the first half. So why give in to the union, especially since the public apparently no longer condones violence?

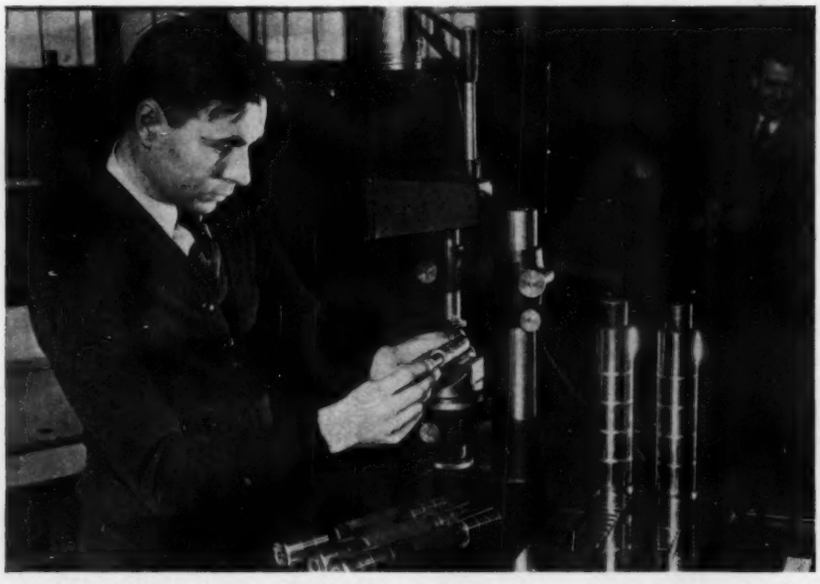
Little Effect on Employment

Employment in the shops of local parts makers has not been materially affected by the General Motors impasse. Such concerns are themselves in the process of tooling up for '40 releases, and could have made little progress for Pontiac and Buick commitments. Some machinery suppliers have been told to hold up shipments of equipment because tooling-up operations have been suspended and conditions are chaotic.

It is unlikely that labor will soon attack Chrysler. That manufacturer will probably have no trouble about its men returning to work on 1940 production, because the demand for its vehicles is so great that almost the entire seniority list will be needed.

Begin 1940 Model Previews

Packard led off the press preview season on August 8. Its dealers participated in the usual triumphant driveaway and the company is now engaged in building up field stocks for an early public showing. Other independents, notably Willys-Overland, Studebaker and Nash, will exhibit their new cars to newspapermen before the 15th. But the Big Three will not show their models until late in the month and in September. Graham-Paige will not have a new model, it is understood.



Gaging Gages—*Accuracy of plug gages used in the Pontiac inspection department is checked to 0.00001 in. with a Zeiss optical comparator. Some 200 master gages are held to within 0.00002 in. for checking such parts as valve stem guides, pinion gears, cylinder bores, and crank and cam bores*

PERSONALS

PHILIP M. GUBA, Chicago district sales manager Carnegie-Illinois Steel Corp., Pittsburgh, Pa., has been appointed Eastern sales manager. GRISWOLD A. PRICE, at present manager of sales, Bar, Strip and Semi-Finished Materials Div., General Sales Dept., succeeds Mr. Guba. He in turn is succeeded by THOMAS J. BRAY, JR., Pittsburgh district sales manager, whose position will be assumed by JOSEPH G. ARMSTRONG, JR.

JOHN E. SNOWBERGER

JOHN E. SNOWBERGER, for the past nineteen years an employee of Willys-Overland Motors, Inc., has been appointed works manager of the company's factory in Toledo, Ohio.

Mr. Snowberger joined Willys-Overland in 1920 in charge of the tool and die design department. In succeeding years he served in the engineering and research departments, and two and a half years ago was promoted to the position of assistant master mechanic, which he has held to the present time.

R. T. SHIELS, manager of the Dallas, Tex., industrial department of the General Electric Co., has been named assistant to the district manager. He is succeeded by H. A. WHITE, manager of the El Paso office. E. C. WISE, of the general sales department at El Paso, has been named manager of that office.

J. B. NORDHOLDT, formerly with the Toledo Steel Casting Co. and the Logan Gear Co., has been appointed general manager of Webster Manufacturing, Inc., Tiffin, Ohio, conveyor manufacturer.

F. H. REYNOLDS, former manager of the Atlanta branch, Crucible Steel Co. of America, New York, N. Y., has been named manager of stainless steel sales with headquarters in New York City.

L. G. FIRTH

J. M. SMITH

T. M. DEAL

L. GERALD FIRTH, president Firth-Sterling Steel Co., McKeesport, Pa., has been elected president of the American Carbide Alloys Corp., Firth-Sterling's newly acquired and wholly owned subsidiary. G. A. JACOBS, of the company's Detroit office has been made first vice-president; W. H. LOLLEY, New York, second vice-president; CLYDE N. GILLESPIE, McKeesport, treasurer; and H. R. HUEMME, McKeesport, secretary.

JOHN M. SMITH, who joined The Crosby Co., Buffalo, N. Y., sheet metal stamping concern, in 1900 as an office boy, has been appointed vice-president and general manager. He succeeds EDWARD F. GRAM, retired.

T. M. DEAL has been named president of the Link-Belt Speeder Corp., recently organized by the Link-Belt Co., Chicago, Ill. The new company is a wholly owned subsidiary, but is operated independently, with headquarters at 301 W. Pershing Road, Chicago. It will engage in the manufacture and sale of power-operated excavating and materials handling shovels, draglines, cranes and similar equipment. The organization of this new company follows closely on the heels of the consolidation of the Speeder Machinery Corp. of Cedar Rapids and the Link-Belt shovel division, which have been merged to form the Link-Belt Speeder Corp.

Other officers of the new corporation include ALFRED KAUFFMANN (president Link-Belt Co.), chairman of the board; WALTER BAKER, vice-president; W. C. CARTER, vice-president; H. E. KELLOGG, treasurer; and G. H. OLSON, secretary.

HENRY R. DEHOLL, general superintendent of the Indiana Harbor works, Inland Steel Co., has resigned after 26 years of service.

GEORGE J. MEAD, one of the founders of the Pratt & Whitney Co., Hartford, Conn., and a director and member of the executive committee of the United Aircraft Corp., has resigned.

BUSINESS ITEMS

Alumaweld Co. of America has changed its name to Lloyd S. Johnson Co. and its address to 2241 Indiana Ave., Chicago, Ill. Management, under LLOYD S. JOHNSON, and personnel remain unchanged.

Burgess-Parr Co., Freeport, Ill., has returned to active promotion of all Illium products with the presentation of new rolled forms of Illium alloy.

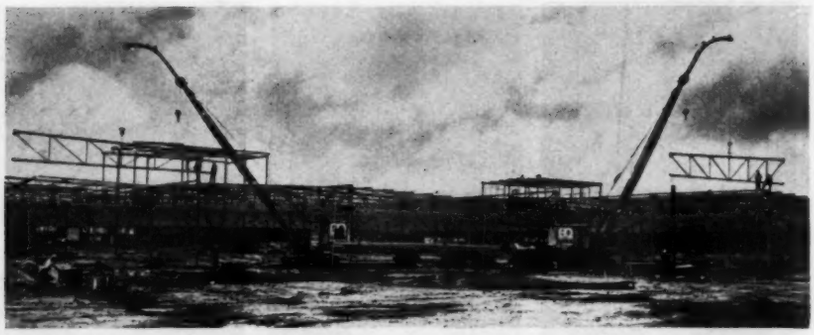
Fedders Mfg. Co., Buffalo, N. Y., has started construction of a $200,000 branch factory at Owosso, Mich., where it will manufacture car heaters and tubular radiators. HAROLD CLIFTON has been named manager of the new plant, which will employ about 200 men. It will not result in any change in operations at the Buffalo plant, which will continue to produce refrigeration equipment and cellular type automobile radiators.

Lukens Steel Co., Coatesville, Pa., has been licensed to produce "Ledloy" lead bearing steels under the Inland Steel Co. patents.

Moore Drop Forging Co., Springfield, Mass., is planning to erect a one-story 148x234-ft. addition to its plant, at an estimated cost of $57,000.

Scott-Bansbach Machinery Co., Chicago, Ill., is dissolving after 20 years of selling new and used machine tools. New companies will be known as Walter C. Scott Machinery Sales, and the Bansbach Machinery Co.

Stewart Motor Corp., Buffalo, N. Y., truck manufacturing firm, has sold its entire plant and equipment to Chinese interests. All machinery will be moved to China where it probably will be used to manufacture trucks similar to those formerly produced by Stewart.



Controlled Conditions for Allison—*Final structural members are placed for the world's largest completely controlled conditions plant being erected in Indianapolis for the Allison Engineering Div. of General Motors. Designed by the Austin Co., it will be acoustically treated and air-conditioned*

OBITUARIES

ARTHUR H. ABBOTT, 56, former General Electric transformer specialist, died July 31 in Winchester, Mass.

SIDNEY CORNELL, former consulting engineer with the Carnegie Steel Co., died July 25 in Orange, N. J., following an extended illness. He was 52 years of age.

EMMONS CROCKER, founder and president Union Screen Plate Co., Lennoxville, Que., and founder of the Union Foundry Co., Fitchburg, Mass., died July 24 at his home in Fitchburg. He was also vice-president of the Union Machine Co. of that city.

JOHN DRAHER, president, Draher Machine Co., Waterbury, Conn., died recently at his home in that city. Mr. Draher was also treasurer of the American Fastener Co. and vice-president of the General Manufacturer Co., also of Waterbury.

JOHN J. GILBERT, export manager International Telephone & Telegraph Corp. and vice-president International Standard Electric Corp., New York, N. Y., died July 26 at his home in Brooklyn, N. Y. He was 67 years of age.

ROSS M. G. PHILLIPS, credited with inventing the world's first air-cooled internal combustion engine, died July 26 in New Haven, Conn., following a recent illness. He was 65 years of age.

RALPH M. RUMBEL, meter division manager of the Newark, N. J., works of the Westinghouse Electric & Mfg. Co., died July 31 in Clarion, Pa. He was 60 years of age.

HENRY D. SHUTE, former vice-president Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and for 38 years connected with the company before his retirement in 1931, died July 15, at his home in Miami, Fla. He was 67 years of age.

ADOLPH TISCHLER, founder and former president Manhattan Metallic Casket Co., New York, N. Y., died July 25 in that city following an operation. He was 77 years of age.

MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with the Institute of Mechanical Engineers of Great Britain, New York, N. Y., Sept. 4–8.

AMERICAN SOCIETY OF TOOL ENGINEERS. Semi-annual meeting, Hotel Statler, Cleveland, Ohio, Oct. 5–6.

AMERICAN WELDING SOCIETY. Twentieth annual meeting, Stevens Hotel, Chicago, Ill., Oct. 23–28.

ASSOCIATION OF IRON AND STEEL ENGINEERS. Thirty-fifth annual convention and iron and steel exposition, Wm. Penn Hotel, Pittsburgh, Pa., Sept. 26–29.

MACHINE TOOL SHOW AND CONGRESS, sponsored by the National Machine Tool Builders Association, Public Auditorium, Cleveland, Ohio, Oct. 4–13.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION. 1939 conference, Hotel New Yorker, New York, N. Y., Sept. 20–22.

PACKAGING INSTITUTE. First annual meeting, Edgewater Beach Hotel, Chicago, Ill., Oct. 12–13.

PORCELAIN ENAMEL INSTITUTE. Fourth annual forum, Ohio State University, Columbus, Ohio, Oct. 18–20.

SILVER BAY INDUSTRIAL CONFERENCE. Annual meeting, Silver Bay, Lake George, N. Y., Aug. 30–Sept. 2.

SOCIETY OF AUTOMOTIVE ENGINEERS. National aircraft production meeting, Ambassador Hotel, Los Angeles, Calif., Oct. 5–7. Annual dinner, Hotel Pennsylvania, New York, N. Y. Oct. 16.

Exports of Machinery During June, 1939

	June 1939	May 1939	June 1938
Electrical machinery	$8,717,087	$8,350,617	$8,342,535
Power generating machinery except automotive and electric	1,101,760	1,185,654	1,441,628
Construction and conveying machinery	2,558,330	1,806,062	2,047,131
Mining, well and pumping machinery	5,894,925	5,163,059	6,419,375
Power driven, metal-working machinery	6,660,447	11,615,799	8,000,189
Other metal-working machinery	403,905	409,836	320,866
Textile machinery	798,865	846,251	598,970

Exports of Metal-Working Machinery During June, 1939

Engine lathes	$379,883	$496,968	$587,931
Turret lathes	432,869	872,409	647,311
Other lathes	335,465	330,819	165,451
Vertical boring mills and chucking machines	177,625	420,959	294,616
Thread cutting and automatic screw machines	474,003	619,940	384,264
Knee and column type milling machines	399,730	705,839	410,894
Other milling machines	627,126	1,510,986	772,421
Gear cutting machines	268,595	280,983	349,201
Vertical drilling machines	121,621	82,511	93,886
Radial drilling machines	75,035	115,599	43,698
Other drilling machines	34,235	152,705	171,286
Planers and shapers	151,293	805,319	253,730
Surface grinding machines	193,667	219,400	152,512
External cylindrical grinding machines	214,493	410,208	647,472
Internal grinding machines	232,900	373,946	225,627
Tool grinding, cutter grinding and universal grinding machines	323,551	381,114	185,043
Other metal-grinding machines and parts	291,525	529,131	136,248
Sheet and plate metal-working machines and parts	238,647	813,187	533,456
Forging machinery and parts	394,220	401,736	406,142
Rolling mill machinery and parts	387,114	1,209,654	737,569
Foundry and molding equipment and parts	68,240	28,091	234,613
Other power-driven metal-working machinery and parts	838,610	853,823	566,818

Other Metal-Working Machinery

Pneumatic portable tools	$111,469	$111,881	$97,976
Other portable and hand or foot-operated metal-working machines and parts	132,120	120,179	134,143
Chucks for machine tools	19,486	25,912	18,856
Milling cutters, machine-operated threading dies and taps, and similar machine-operated metal cutting tools	72,355	70,850	42,995
Other metal-working machine tools and parts	68,475	81,014	26,896

SHOP EQUIPMENT NEWS

Model 12 Automatic Stub Lathe Broadens Line Offered by Sundstrand

The Sundstrand Machine Tool Co., Harrison and 11th Sts., Rockford, Ill., now is offering the Model 12 automatic Stub Lathe in addition to the Model 8 and Model 10 lathes previously announced. All three models today represent the consummation of numerous improvements developed since the earlier Model 10 Stub Lathe was introduced in 1935. Among the features claimed for these lathes are simple set-up, quick action, easy change-over and economical operation for both long and short run jobs.

Wide range of action for front carriage tools is provided by three units, which can be used separately or in combination. These give: (1) angular feed-in and tool relief; (2) slow-up and dwell, and (3) straight feed-in and tool relief. These units can be added to the standard lathe at any time to meet additional cycle requirements. The automatic cycle control incorporated in these lathes eliminates making cams and provides complete control of all cycles by the adjustment of dogs on a disk. The edge of the disk is graduated, aiding the operator to set up cycles quickly and to change from one job to another easily. A total of six dogs control all cycles.

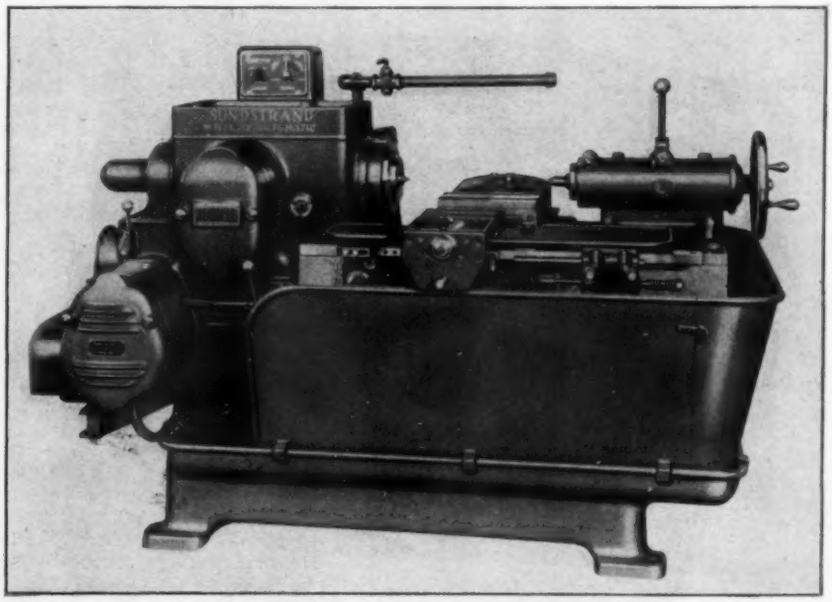
In these lathes the tools approach and return at 250 in. per min., and feed at the highest rate the work will stand. A skip feed-dog rapidly traverses turning tools between separated surfaces except when rear-slide facing is continuous. Rapid return takes place immediately after the cutting cycle is completed.

In all three lathes the front carriage and rear slide are fitted to pressure-lubricated hardened steel ways which are protected by wipers. These machines have the stability to carry heavy pressures smoothly, a major factor in working tungsten carbides to capacity.

Specifications for Model 12 lathe: lengths between centers, 16, 22 and 34 in.; spindle drive motor recommended, 10, 15 or 20 hp.; distance from floor to center line of spindle, 40 in.; spindle nose, 8 in. Type A2 N.M.T.B.A. standard; length of front carriage, 22 in.; maximum longitudinal feed with angular feed-in, 11 in.; maximum straight feed-in, 2 in.; maximum longitudinal feed with straight feed-in, 5⅜ in.; maximum swing over carriage, 13½ in. diameter; standard swing over cross slide, 10½ in.; maximum swing over cross slide, 12 in.; maximum micrometer adjustment of cross slide, 2½ in.; range of front carriage feed per spindle revolution through pick-off gears, 0.0039 to 0.0684 in.

Length of rear slide, 21½ in.; longitudinal adjustment of rear slide, 16 in. maximum; transverse micrometer adjustment of rear slide, 2½ in.; total stroke of feed cam on rear slide, 4 in.; lead of standard cam for rear slide, 3½ in.; swing over rear slide, 12 in. diameter; range of feeds per spindle revolution, 0.0012 to 0.1387 in.; tailstock is furnished for hand lever or hand wheel operation as standard, but can be arranged for pneumatic or hydraulic operation; tailstock sleeve adjustment, 4 in.; tailstock sleeve stroke, 4 in.; several spindle speed ranges are furnished ranging from 21–195 to 168–1,500 r.p.m.

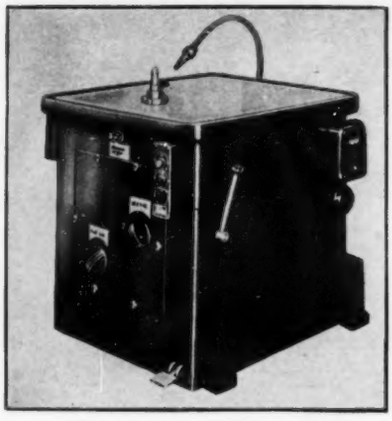
All cycles of the stub lathe are controlled by the adjustment of dogs on a graduated disk as shown. Only a set-screw wrench is needed



The Model 12 automatic Stub Lathe offered by Sundstrand features simple set-up, quick action and easy change-over.

Honing Spindle Operates Vertically

A honing machine with a spline-type spindle, which operates vertically through the work-table, and with knob controls for changing independently the spindle reciprocating and rotating speeds is being marketed by the Honing Equipment Corp., 4612 Woodward Ave., Detroit, Mich. The machine has a foot-pedal control for stopping the spindle without stopping



the motor. A hand control lever starts and stops the spindle and is engaged with the foot control lever, so that when the spindle is started again, the foot lever automatically is set for stopping. Starting, stopping and inching is accomplished by push-button control.

The design of the machine leaves the table clear for the installation of fixtures and for gaging the work piece without removing it from the machine or fixture. The coolant reservoir and operating motors are inclosed in the cabinet base. The illustrated machine is equipped with a 1-hp. motor and has reciprocating speeds of 700 to 1,000 cycles per min. and rotation speed from 0.9 to 27 r.p.m. The machine is capable of honing and finishing bores up to 2 in. diameter.

Additional Presses Announced by Colonial

The Colonial Broach Co., Detroit, Mich., has expanded the "Junior" line of hydraulic presses to include five basic models in four capacity ranges and three strokes. The original press in this line was the previously described ½-ton unit (*AM*—Vol. 83, page 418).

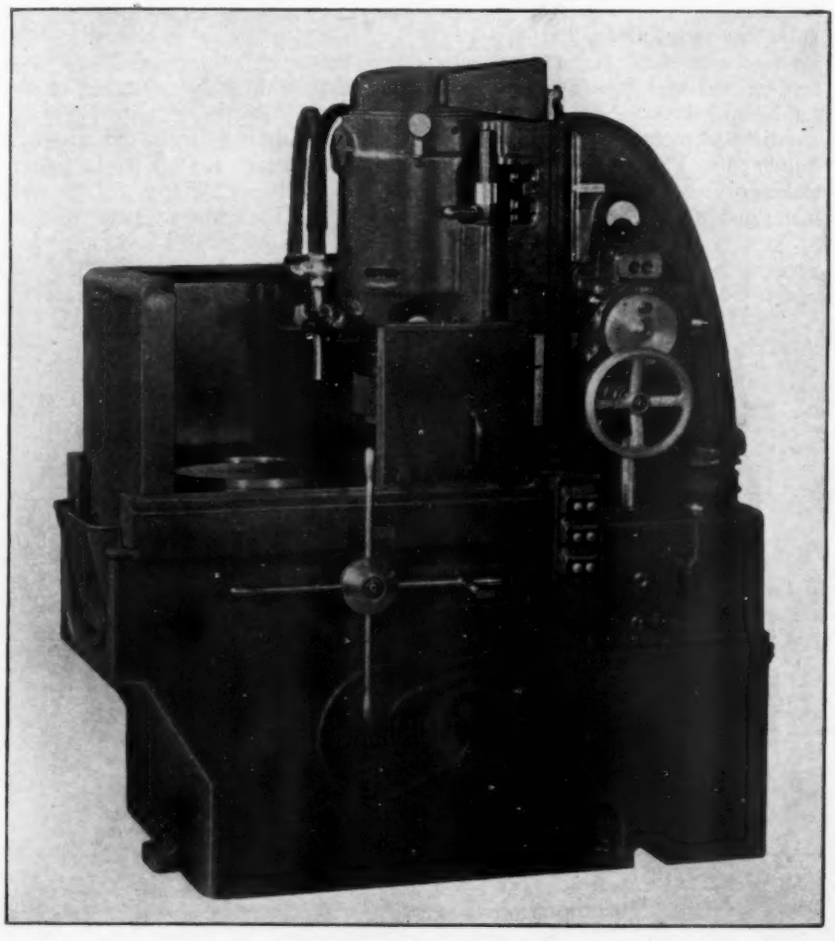
The line now includes a ¼-ton press with 9-in. stroke, the previously announced ½-ton model with 12-in. stroke; a 1-ton model with 12-in. stroke, and another of similar capacity, but with 18-in. stroke; and a 2-ton press with an 18-in. stroke. All models are similar in general design and construction, differing mainly in dimensions.

The completely self-contained operating system in all models includes constant delivery pumps of 1,000 lb. per sq. in. pressure capacity submerged in an oil reservoir in the base of the press column. Ram control is through a four-way valve, operated either manually or automatically. The hydraulic system also includes an adjustable pressure relief valve so that the maximum ram pressure may be adjusted to any desired amount within the capacity of the machine. Ram speed down is 30 ft. per min. and return speed is 60 ft. per min. in all models.

No. 11 Blanchard Surface Grinder Features Conveniently-Placed Controls

The No. 11 surface grinder announced by the Blanchard Machine Co., 64 State St., Cambridge, Mass., has been designed for easy handling with all controls conveniently placed for quick operation. The 11-in. wheel is driven by a 15-hp. induction motor mounted directly on the wheel spindle, and has a capacity for grinding work up to 20. in. in diameter by 8 in. high under a new wheel. The machine is driven by a total of four motors, each direct-coupled to its load. One of these motors provides for rapid-raising and lowering of the wheel head by power with pushbutton control.

The No. 11 grinder, which supersedes the No. 10 grinder, surpasses the No. 10 unit in capacity, power and rigidity. Its larger wheels operating at a lower wheel speed is said to result in faster and cooler grinding with less wheel wear. An improved speed gear box designed for this machine provides for sensitive hand feeding, also power feed at rates varying from 0.004 to 0.070 in. per min. with automatic stop. The feed and the rapid raising and lowering of the head are interlocked. Features common to other Blanchard surface grinders, such as one piece steel magnetic



THE MACHINE AGE OF TOMORROW

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Because it is geared to the production of only one product — because it concentrates on the building of milling machines exclusively—the K & T organization more than keeps pace with today's needs and frequently anticipates tomorrow's demands in advanced milling machine design and construction.

The machine age of tomorrow will find in Milwaukee Milling Machines the same high standards of performance it profits by today.

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PROFIT MORE WITH K&T PRODUCTS

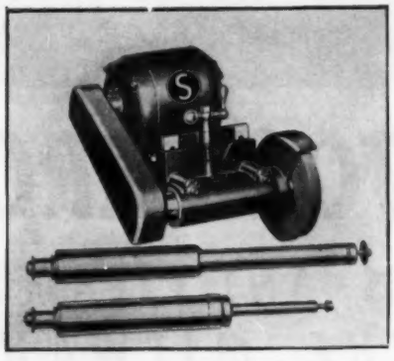
K&T *Milwaukee* MILLING MACHINES

chuck, three-point adjustable column supports, and easy cleaning base are incorporated in the No. 11 grinder.

The base of the machine serves as a tank for the coolant and has a capacity of more than 75 gal. In an extension of the tank at the back of the base is the motor-driven centrifugal pump supplying water to the inside of the wheel and to an outside nozzle through a ¾-in. pipe. Over-all height of this grinder is only 63 in. and width is 42 in. Height of the chuck from the floor is 36½ in.

Grinders now Built with Interchangeable Spindles

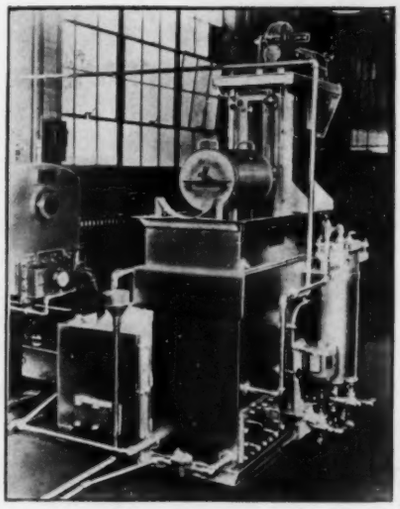
Standard Type BPA precision grinders, built by The Standard Electric Tool Co., 1940 West 8th St., Cincinnati, Ohio, have interchangeable spindle units for internal and external grinding. These belt-driven grinders,



with the wheel overhanging the front of the machine, are available in sizes ranging from ¼ hp. to 10 hp. for application to lathes, planers, boring mills and milling machines. Open or inclosed internal spindle assemblies are interchangeable and available in various lengths. Grinding on centers is accomplished by an adjusting screw for raising and lowering the spindle assembly.

One-Dip Degreaser Has Rotating Baskets

Cup-shaped work can be degreased in the special one-dip "Detrex" rotating-basket type degreaser developed by Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich. Work is said to come from this degreaser clean, warm and dry; free from any trace of solvent vapors, chips or abrasive. This degreaser consists essentially of a one-dip or liquid-vapor design with storage tank and an automatic elevator mechanism which raises and lowers the rotating baskets. A



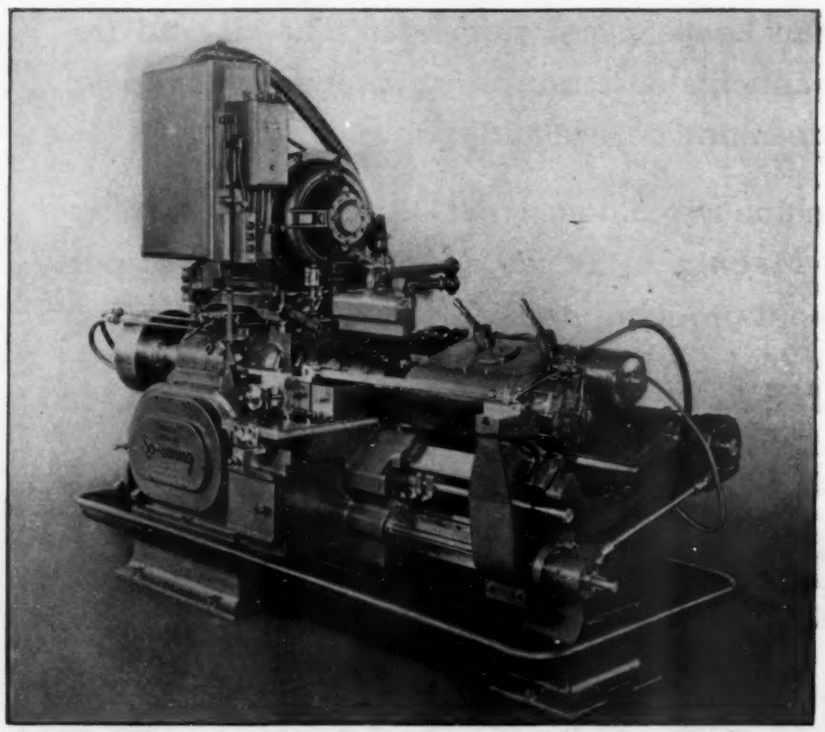
continuous filter at the side of the machine is used to keep the boiling chamber free of insoluble material and a continuous solvent still is used to remove oil contamination. By this means, the work always is immersed into clean solvent, and a final pure-vapor cleaning action is given as the work is raised out of the boiling solution.

The drum-shaped mesh basket with which this machine is equipped fits over a spindle attached to the elevator mechanism. It has a gear and pinion to cause rotation of the basket during its descending and ascending travel. After the set time interval for cleaning in the boiling solution, the load returns automatically to the loading-unloading station.

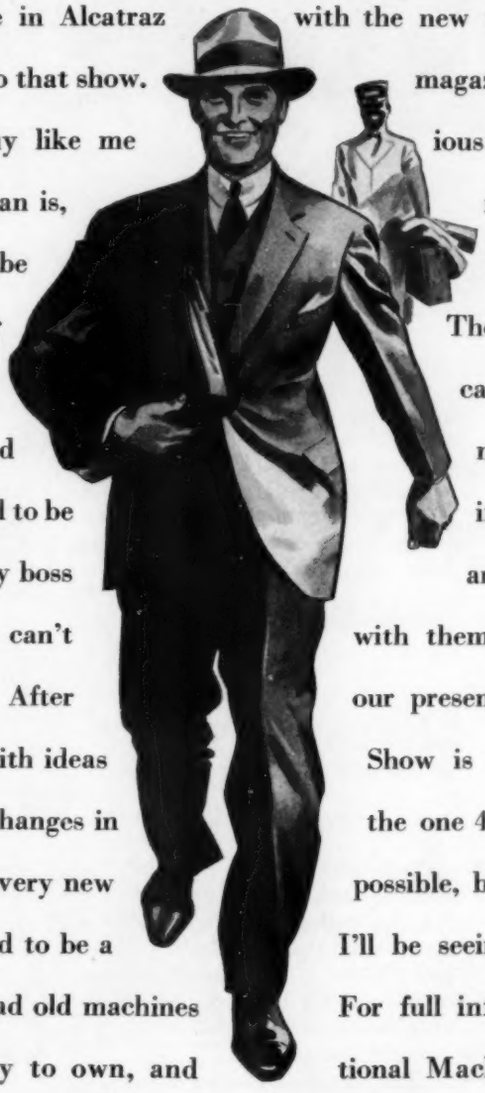
This rotating-basket design of degreaser is offered in various sizes ranging in capacity up to 2 tons per hour. The unit shown has the following over-all dimensions: length, 4 ft.; width, 4 ft. 8 in.; height, 7 ft. 2 in. Operating height to center line of basket spindle is 4 ft. 8 in. The rotating baskets are 12 in. in diameter, and 15 in. long. Solvent capacity of the boiling chamber is 61 gal. and the storage tank is of sufficient size to hold all of the solvent.

Model R-14 "Lo-Swing" Automatic Lathe Has Quick Change-Over Mechanism

The Seneca Falls Machine Co., Seneca Falls, N. Y., has announced a heavier Model R "Lo-Swing" lathe to be known as the Model R-14. This is a fully automatic lathe equipped with the all-mechanical quick change-over mechanism which makes it possible to change the stroke by merely setting a graduated dial. This lathe will handle heavy multiple tools turning work 10 to 11 in. in diameter and up to 36 in. between centers. It is a fully-mechanical lathe and can be serviced easily by any mechanic. The machine illustrated is equipped with special motor-driven tailstock to provide long



You couldn't keep me away from it!



"AM I going to the Machine Tool Show? Why, listen, if they had me in Alcatraz I'd get away somehow to go to that show. That's something that a guy like me simply has to do. What I mean is, among production men there'll be just two kinds of people after October 13—those who went to the Machine Tool Show and those who didn't. I can't afford to be one of the second kind. And my boss is smart enough to know he can't afford to have me miss it. After the 1935 Show I came back with ideas that resulted in a number of changes in equipment. And believe me, every new machine tool we bought proved to be a wonderful investment. We had old machines that were costing us money to own, and the Machine Tool Show gave us just the information we needed to have. I try to keep up with the new things as they come out in the magazines and literature from the various machine tool builders, but there's nothing like seeing the machine itself and watching it operate. There at the Show in Cleveland I can see them all — every kind of machine tool with the very latest improvements — under one roof; and all the newest gadgets to go with them — a lot of them adaptable to our present equipment. I hear this year's Show is going to be even better than the one 4 years ago! That sounds hardly possible, but I'm not taking any chances. I'll be seeing you in Cleveland. . . . . ."

For full information, please address National Machine Tool Builders' Association, 10525 Carnegie Avenue, Cleveland, Ohio.

MACHINE TOOL SHOW OF 1939

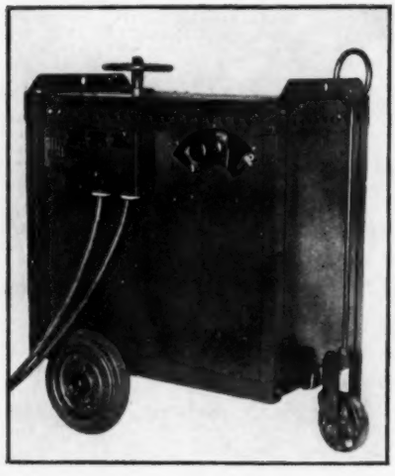
CLEVELAND • OCTOBER 4TH TO 13TH

YOUR SMARTEST INVESTMENT TODAY . . . MODERN MACHINE TOOLS

travel. All Model R-14 lathes can be equipped with an overhead third arm. This machine weighs slightly over 14,000 lb. with average equipment.

Transformer-Type Welder Has 400-Amp. Capacity

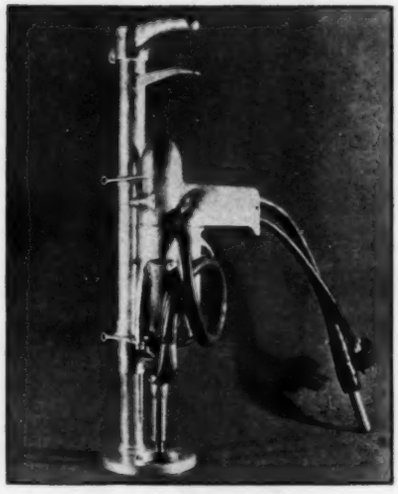
The Owen Electric Mfg. Co., P. O. Box 235, Fayetteville, N. C., has announced the development of a transformer-type welder which has a capacity of 20 to 400 amp. The machine accommodates all types of electrodes used commercially with both a.c. and d.c. equipment, and is said to perform especially well with electrodes made for use with d.c. welders. Among the features claimed for this machine are high power factor and ease of operation. Any desired stepless setting is obtained by turning the handwheel attached to the movable



reactor core. The high efficiency, high power factor and good welding qualities are claimed to be the result of a system utilizing oil-filled condensers in both primary and secondary circuits, which automatically are thrown in and out.

Electric Welding Gun Welds Studs to Plates

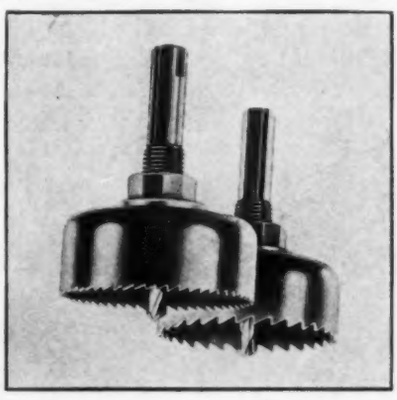
A light-weight electric welding gun has been developed by Ted Nelson, 1926 Marin St., Vallejo, Calif., especially for welding studs to deck plates. This gun weighs approximately 6 lb. From 8 to 10 brass screws or studs can be welded to brass or steel plates per minute. To make a weld, a stud is inserted into the chuck and a lever on the stand is compressed to leave the stand free. The gun then can be lowered into the hole in the deck plank until the stud touches the plate. The stand is locked in this position, and a



trigger is pulled which turns on the welding current and picks up the stud to a predetermined height. This creates an arc between the stud and plate, making a molten crater for the weld. At the same time, the timing device goes into action and after a given time has elapsed the gun is tripped to force the stud into the crater. As this occurs, the current is turned off and the weld is complete. The gun is designed so that the stand shown can be removed and tripod legs mounted. When tripod legs are used, the gun is suitable for welding studs directly on the metal surface without penetrating wood holes. In use, the gun is connected to a 300–400 amp d.c. welding generator, using regular welding leads.

High-Speed Hole Saws Made for ½-in. Drills

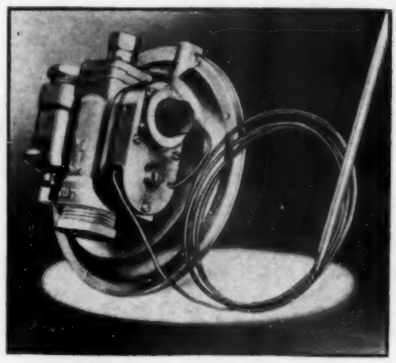
A line of high-speed hole saws for use in ½ in. or larger electric drills has been placed on the market by the Black & Decker Mfg. Co., Towson, Md., for cutting clean, round holes in any material that a hacksaw will cut. The addition of high-speed hole saws rounds out the Black & Decker line with three types—fine tooth for sheet



metal, steel and all thin materials; coarse tooth for cast iron, wood, fibre and all thick materials; and the new high-speed type for hard alloys and production work. Of interest to many users is a mandrel for ¼- and ⅜-in. drills which can be used to drive hole saws up to 1½ in. in diameter.

Modulating Gas Valve Controls Temperatures

The Model 1224 modulating gas valve developed by Wheelco Instruments Co., 1929-1933 S. Halsted St., Chicago, Ill., is a self-actuated temperature controlled valve which is, in effect, a complete temperature control system in a single unit. It is designed to operate as a combination on-off and throttling control, and to



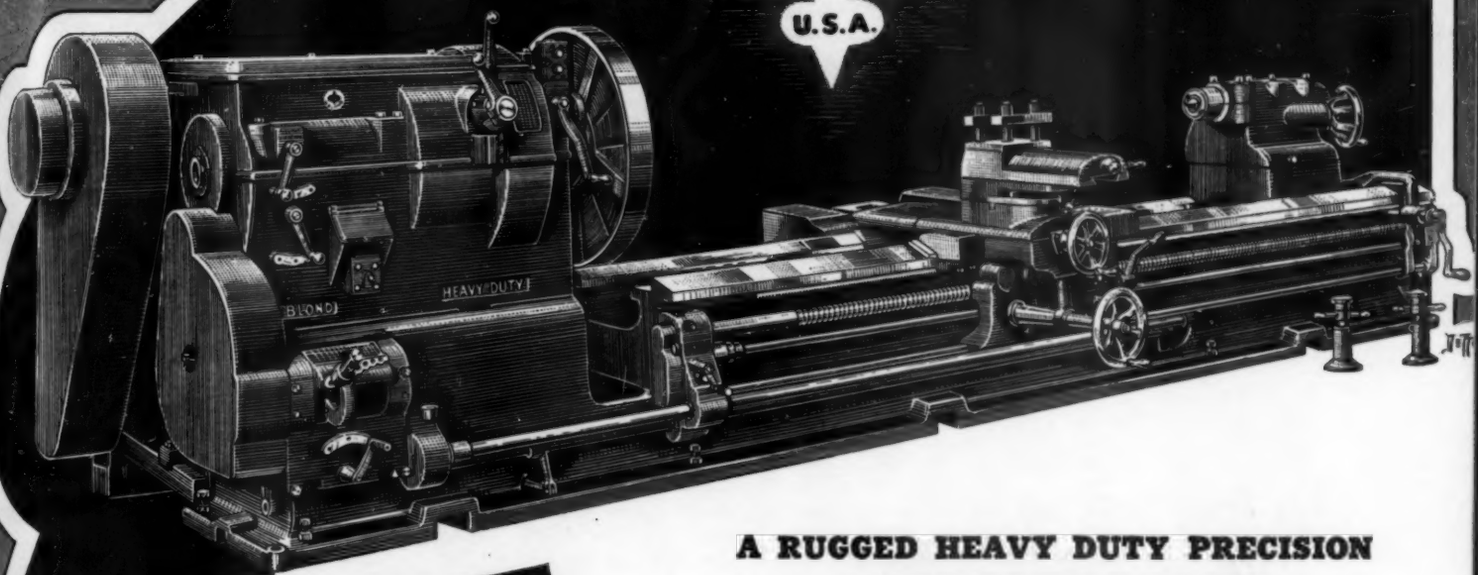
eliminate the possibility of "blow-backs." The temperature sensitive element, upon being heated or cooled, within the throttling range, actuates a double seated valve and proportions the flow of gas to the temperature demand. As the temperature approaches the upper limit of the throttling range, the tendency for "blow-back" is eliminated by the on-off control which completely shuts down gas flow.

Wheelco "Rheotrol" Controls Furnaces

A stepless manual control for electrically operated furnaces, ovens, heaters and kilns, the "Rheotrol" unit offered by Wheelco Instrument Co., 1929–1933 S. Halsted St., Chicago, Ill., is claimed to make possible a saving in power consumption. The "Rheotrol" unit is an easily adjusted input controller in which power consuming resistors are replaced with rotating cams operating switches to effect make and brake control. Adjustment of the unit is accomplished by variable ratio settings of the rotating

THE HEAVY DUTY SLIDING BED GAP *Lathe*

LeBLOND
CINCINNATI, OHIO
U.S.A.



A RUGGED HEAVY DUTY PRECISION LATHE OF WIDE RANGE VERSATILITY AND REAL ECONOMY

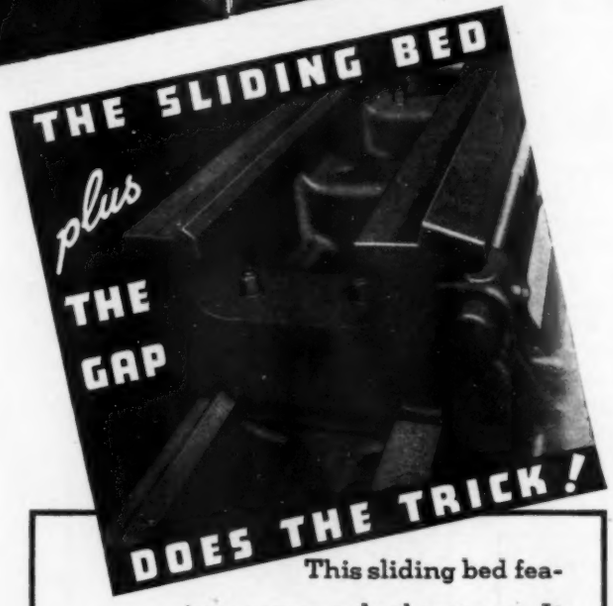
The LeBlond Sliding Bed Gap Lathe, because of its extreme flexibility, is ideal for the plant where the work is irregular in size or shape, with projecting parts, requiring varying center distances and greater clearance.

This one flexible lathe embodies the work capacity of several individual lathes . . . eliminates the need for a wide range of turning equipment.

This remarkable lathe is built in three sizes: 19-38 inch, 25-50 inch, 30-60 inch. On the 19-38 inch, the upper bed slides on the lower for a minimum of 3½ feet; on the 25-50 inch, 5 feet; and on the 30-60 inch, 6 feet.

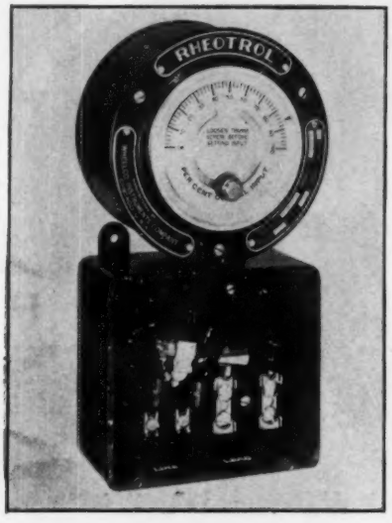
If your work demands flexibility and versatility in your lathes . . . if economy is necessary in original cost as well as in operating cost, the LeBlond Sliding Bed Gap Lathe is the perfect answer.

For additional details write today for Bulletin SBG-537. Address Dept. H-25, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.



This sliding bed feature serves a dual purpose. It widens the gap to provide essential clearance for irregular or projecting parts, and increases the length which may be taken between centers.

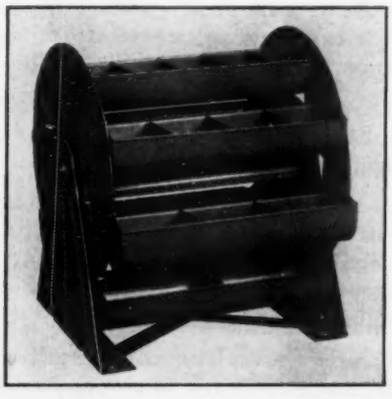
LOWER YOUR COSTS WITH LeBLONDS



cams. In the Model 684 instrument shown, the switches actuate a mercury tube tipping mechanism. It functions to balance the heating rate of furnaces, ovens and heaters with the varying heat requirements. On-off control of heating rate is effected once every minute interval.

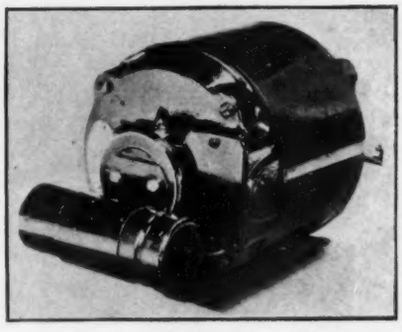
"Kari-All" Assorter Has 30 Compartments

Of all-steel construction and containing eight troughs having 30 compartments, the "Kari-All" parts assorter developed by Diagraph-Bradley Stencil Machine Corp., 3745 Forest Park Blvd., St. Louis, Mo., occupies little space and can be placed on a bench or fastened to a wall. In appearance, this unit resembles a ferris wheel and any of the eight troughs can be brought into position easily. This assorter can be used for holding small parts for the production shop or maintenance department. It also has use in the shipping department for holding seals, tag hooks, pins, nails and crayons. Weight is less than 10 lb.



Capacitor Motors Have Multi-Speed Features

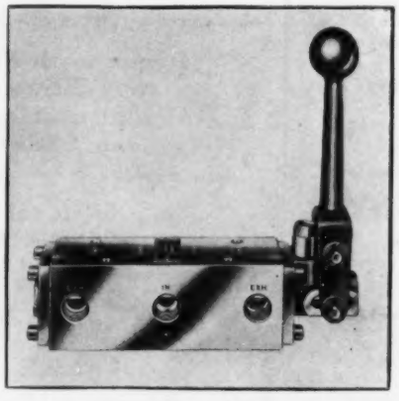
Available in 1/20 to ¾ hp. sizes, a capacitor-type motor developed especially for unit heater, fan and blower applications by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., provides single speed operation with the ordinary on-and-off switch for either 110 or 220 volt circuits, with an inexpensive two-speed switch giving high and low speed operation,



and with a speed controller giving multi-speed operation, with either voltage. An oversize shaft between the bearings reduces bearing wear and vibration and maintains constant air gap. Special sleeve bearings absorb shocks and large oil reservoirs packed with yarn insure adequate lubrication.

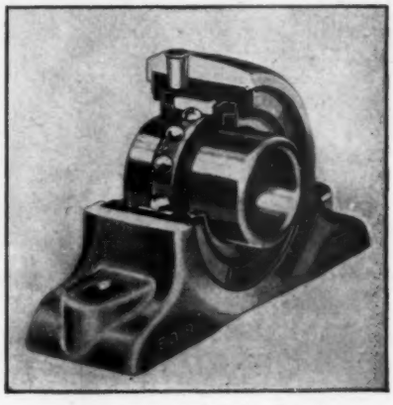
Single-Plunger Valve Of Simple Design

Only one moving part is included in the design of the single-plunger air or hydraulic valve announced by C. B. Hunt & Son, 1923 E. State St., Salem, Ohio. The "quick-as-wink" valve principle is used in this design to provide balanced action. With outlets and inlets in the sides, this valve can be serviced on the job without dismounting. Having individual exhaust outlets controlling each end of a double-acting cylinder, speed control of the piston is easily obtained independently in either direction. This valve is made in 25 styles of valve control, and in sizes ranging from ⅛ to 1½ in., inclusive.



"Murco" Unit Heaters Use Steam or Hot Water

Either steam or hot water can be used in the improved "Murco" unit heaters manufactured by D. J. Murray Mfg. Co., Wausau, Wis. Sixteen sizes are offered to meet various space heating requirements. Heating elements are of heavy-wall copper tubes. The condenser is full floating to overcome contraction and expansion. Each unit is equipped with a totally inclosed motor.



Ball-Bearing Pillow Blocks Are Sound Insulated

The ED-R series of pillow blocks offered by the Ahlberg Bearing Co., 3025 W. 47th St., Chicago, Ill., have been designed for noiseless anti-friction efficiency on applications where the cost of ball bearings has hereto-

A GREAT STEP FORWARD IN A FORWARD STEPPING INDUSTRY

With a capacity up to 1½" solid stock, spindle and gears mounted in anti-friction bearings and many other mechanical features found only in larger machines, the new "RAPIDUCTION JUNIOR" is a great step forward in the threading industry.

The "RAPIDUCTION JUNIOR" is so constructed that with die-head and carriage removed it can be adapted to chamfering, drilling, reaming, boring, tapping and many other jobs.

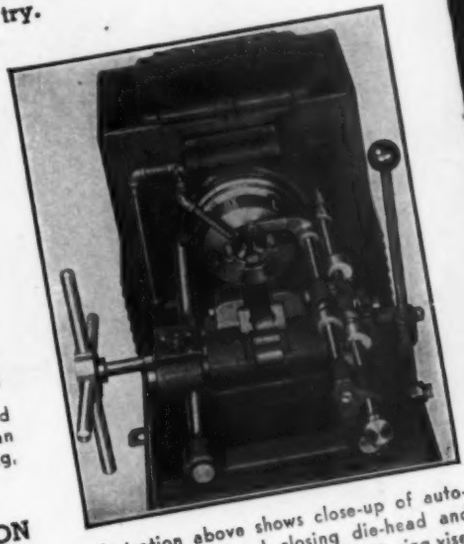


Illustration above shows close-up of automatic opening and closing die-head and stock-stop; open type, quick-centering vise; feed lever and rigidly supported ways on which carriage is mounted.

Investigate the "RAPIDUCTION JUNIOR" as a means of reducing your threading costs at the lowest possible initial investment. Get details and specifications today, from—

THE OSTER MANUFACTURING COMPANY

Sales office: 2049 East 61st Street, Cleveland, Ohio
Factories—Erie, Penna., and Cleveland, Ohio
New York City Office, 30 Church St.
Philadelphia Office, 111 No. 3rd St.

Threading Headquarters Since 1893

OSTER
THREADING EQUIPMENT
WILLIAMS

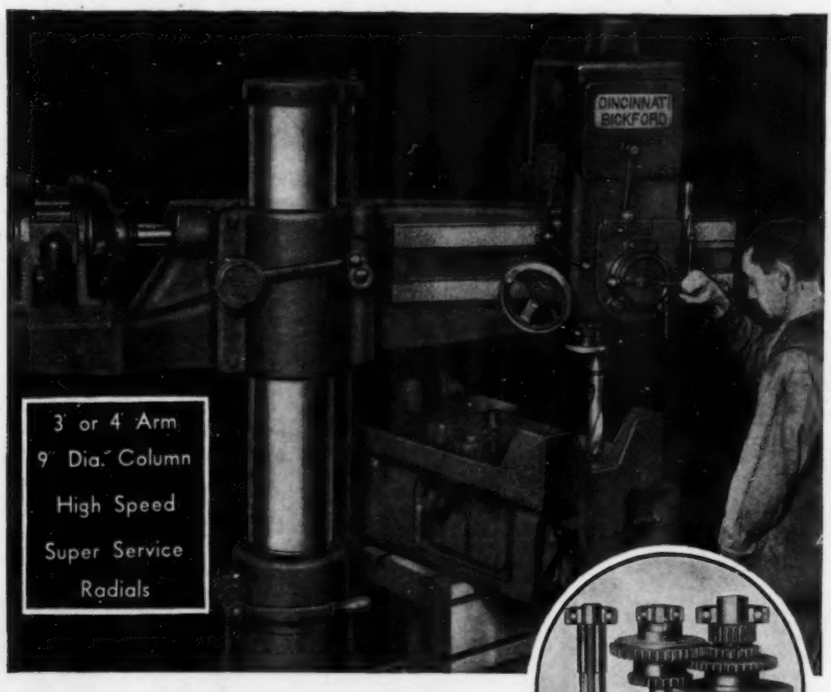
fore been prohibitive. The precision CJB bearing in the ED-R pillow block is insulated from the metal housing by a molded cushion of Neoprene, a synthethic rubber impervious to oil and grease. It is this construction which dampens noise and vibration.

New Meehanite Alloys Announced by Institute

Meehanite Research Institute of America, Inc., 311 Ross St., Pittsburgh, Pa., has announced that two new types of Meehanite Metal have been developed as a result of cooperative research by members of the institute. Super A Meehanite is an alloy material using copper largely as the base alloy. This metal has been found to provide an increase in hardness and wearing qualities accompanied by an improvement in machinability. For example, it is said that Super A Meehanite at 269 Brinell has been found to machine 20 per cent faster than alloy cast iron at 207 Brinell.

This metal has a high modulus of elasticity, a good degree of toughness, and a tensile strength in excess of 50,000 lb. per sq. in. It has been found to be adaptable to the construction of internal combustion engines, marine cylinders and machine parts where smooth running qualities are of primary importance. It also has found use in the production of large gears, piston rings and other parts operating under severe conditions.

Super WH Meehanite is a wear-resistant material possessing a good combination of physical properties and may be made with Brinell hardnesses up to 578, according to the service requirements of the application. This metal has found use in castings subjected to extreme wear, such as ball mill liners, muller tires and pan bottoms.



9 Spindle Speeds Only 11 Gears

Years of quiet, trouble-free, efficient operation are assured from this radial drill gear train. Nine spindle speeds are obtained with but eleven gears and at each speed there are only two gear contacts. This vital part of the Super Service Radial is noted for its compact simplicity.

Other construction features include—hardened chrome nickel steel gears, multiple splined shafts and anti-friction bearings which are automatically oiled and completely sealed against dirt.

Write for Bulletin R-21A.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

Stripper Aids Removal Of High-Baked Enamel

The Enthone Co., 442 Elm St., New Haven, Conn., has developed a stripper for rapidly removing high baked synthetic enamels from all types of base metals, such as magnesium alloys, zinc base die castings, aluminum and steel. It is claimed this solution will not etch or attack these metals, and that after stripping of the enamel they are left clean and bright. Diluted with water, the stripper is claimed to be non-caustic, and to remove completely the enamel in from one to three minutes.

Morse Counterbores Available in Sets

To its line of spline taper drive counterbores the National Twist Drill & Tool Co., 6522 Brush St., Detroit, Mich., has added sets of counterbores designed to meet the needs of the average toolroom and small shop. The No. 2 toolroom set has two holders and interchangeable cutters ranging from $\frac{1}{2}$ to $1\frac{1}{4}$ in. diameter inclusive. Pilots range from $\frac{9}{32}$ to $\frac{7}{8}$ in. and are interchangeable within the respective ranges of cutters and holders. In addition, there are countersinks for 60, 82 and 90 deg. included angles. Also available are the No. 1 set, having a range from $\frac{1}{4}$ to $\frac{7}{16}$ in. diameters, and the No. 3 set, having a range up to 3-in. diameter.

"Hardweld" Electrode Builds Up Surface

"Hardweld 50" is a medium carbon steel electrode designed by the Lincoln Electric Co., 12818 Coit Road,

Cleveland, Ohio, for the building up of steel parts and surfaces. The deposit has considerable resistance to deformation and wear, and is machineable at slow speed. The dipped coating stabilizes the arc and permits the deposition of a tough dense medium carbon steel.

In general, when deposited on straight carbon steel and allowed to cool naturally, the hardness of the deposit will be approximately 20–35 Rockwell C. The exact hardness will depend somewhat on the rate of cooling and the analysis of the steel on which it is deposited. Deposit may be hardened by the usual water quench from above approximately 1,500 F., or by flame hardening methods. This electrode can be used for vertical welding, but for best results work should be fairly horizontal.

TRADE PUBLICATIONS

CONTOUR SAWING The new Model 24M "Di-Saw" is described in a 12-page illustrated catalog published by the Tannewitz Works, Grand Rapids, Mich.

COOLERS Bulletin No. S-500-B37, issued by the Worthington Pump & Machinery Corp., Harrison, N. J., provides specifications of a line of evaporative coolers for engine jacket water.

CUTTER A series of leaflets issued by Ralph W. Poe, Canton, Ill., describes and illustrates the "Ralpo" cutter for use with sheet metal of 16 gage and lighter.

DRILL JIGS Features and specifications of a line of drill jigs are provided in a series of data sheets offered by Esco Engineering & Sales, Inc., 4612 Woodward Ave., Detroit, Mich.

FLUORESCENT LAMPS Booklet No. Ld-1 (Sup.) published by the Nela Park Engineering Dept., General Electric Co., Cleveland, Ohio, provides 16 pages of engineering data on fluorescent Mazda lamps. Included are lamp operating data, performance factors, color quality characteristics and application considerations.

GAGES A catalog providing specifications of an extensive line of gages has been made available by the Ashcroft American Gage Div., Manning, Maxwell & Moore, Ind., Bridgeport, Conn.

GEAR TESTER An 8-page bulletin issued by the National Broach & Machine Co., Shoemaker & St. Jean Sts., Detroit, Mich., discusses features of the "Red Ring" gear speeder for checking gears for noise.

LUBRICATION "Serving Industry," a 36-page illustrated booklet published by the Sun Oil Co., 1608 Walnut St., Philadelphia, Pa., discusses the role of lubricants in many phases of industry.

MAGNETIC SEPARATOR Bulletin No. 93-A, issued by the Stearns Magnetic Mfg. Co., Milwaukee, Wis., discusses Types LS, LP and LD automatic spout drum magnetic separators.

MATERIALS HANDLING A 4-page illustrated folder, Form B-239, offered by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, illustrates numerous applications of the "Cleveland" tramrail system of materials handling.

METAL CLEANING Catalog No. 40, published by N. Ransohoff, Inc., Cincinnati, Ohio, provides 24 pages

New! A Complete Line of Low-cost Hydraulic Presses by Colonial for Bench Assembly and Broaching

¼ Ton 9" Stroke • ½ Ton 12" Stroke • 1 Ton 12" Stroke • 1 Ton 18" Stroke • 2 Ton 18" Stroke

Self-contained Smooth — Fast Sturdy

send today for Bulletin VJ1-39 giving details on these time- and money-savers.

COLONIAL BROACH COMPANY

147 Jos. Campau
Detroit, Mich.

of illustrations and information concerning an extensive line of machinery for washing, rinsing, drying, burnishing and pickling metal parts.

MOTOR DRIVES A folder now being distributed by the Quality Hardware & Machine Corp., 5849 Ravenswood Ave., Chicago, Ill., discusses the application of individual motor drives to various types of machine tools.

NICKEL STEELS International Nickel Co., 67 Wall St., New York, N. Y., is now distributing a revised edition of its "Hardness Conversion Table for Nickel Alloy Steels."

PIPE "Toncon Iron Pipe for Tough Service", a two-color 44-page catalog, No. ADV 333, published by the Advertising Div., Republic Steel Corp., Cleveland, Ohio, discusses the manufacture, physical properties, and application of Toncan cooper-molybdenum iron pipe.

PRESSES Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill., has issued two bulletins dealing with recent press developments. No. 46 includes eight pages of specifications regarding a line of pneumatic arbor presses, while No. 47 contains four pages dealing with finger-tip pressure control for hydraulic presses.

PUMPS Specifications of the Type AO "HiVoL" horizontal piston pumps of high volumetric efficiencies for handling highly volatile liquids are provided in Bulletin No. W-111-B6C, issued by the Worthington Pump & Machinery Corp., Harrison, N. J.

SANDCUTTER Information concerning the Model AM sandcutter is contained in Catalog No. 25, published by the American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.

SHIMS A folder being distributed by the Laminated Shim Co., 21–86 44th Ave., Long Island City, N. Y., illustrates many applications of "Laminum" solid shims which peel for adjustment.

SUPERFINISHING A folder released by the Norton Co., Worcester, Mass., illustrates a line of machines, wheels and stones especially designed to perform superfinishing operations.

TOOL GRINDER A leaflet issued by Willey's Carbide Tool Co., 1342 West Vernor Highway, Detroit, Mich., includes specifications of the No. K-20 tungsten carbide tool grinder.

TRANSFORMER FANS An illustrated folder, Form No. 1931, offered by the Diehl Mfg. Co., Elizabethport, N. J., provides specifications of a line of portable transformer cooling fans.

TRUCKS A 16-page catalog published by the Crescent Truck Co., Lebanon, Pa., illustrates a line of industrial electric trucks, tractors and trailers.

TURRET LATHES "Down-to-earth Facts on an Up-to-the-Minute Industry," a 24 page illustrated bulletin issued by the Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio, discusses many applications of turret lathes in producing precision parts for the aircraft industry.

VALVES An illustrated folder released by the Crane Co., 836 S. Michigan Ave., Chicago, Ill., discusses service characteristics of globe and gate valves.

VARIABLE TRANSMISSION An 8-page illustrated folder offered by the

A man is known by the company he keeps and so is a precision grinder. Here's "Tom Thumb" doing a neat piece of internal grinding on a famous Hardinge bench lathe.

Where accuracy is a "command"— trust a "Tom Thumb"... the new Dumore No. 14 Precision Grinder... to deliver the goods. In the photo above, "Tom" is working on a Hardinge bench lathe at the Frankford Arsenal . . . grinding a mirror-like finish, internally, on a fuse plate gage . . . to an accuracy of .0001". Weighing but 6½ lbs., with a universal 1/14 H.P. motor and a top spindle speed of 19,000 R.P.M., Tom Thumb's the answer to the shopman's prayer for a small, internal-external precision grinder. Ask your industrial distributor for a demonstration; no obligation.

THE DUMORE COMPANY, Dept. 139-H RACINE, WIS.

DUMORE

PRECISION GRINDERS

Columbia Vari-Speed Co., Liberty Building, Wheaton, Ill., illustrates applications of the "JFS-Jr." variable-speed V-belt transmission.

VENTILATION Several types of exhaust fans for light industrial service are described in a 16-page catalog, No. 30-D-1, issued by the Emerson Electric Mfg. Co., St. Louis, Mo.

WASHROOM FIXTURES Details of a line of washfountains, treadle-operated showers, shower receptors, and other washroom fixtures are presented in a catalog supplement offered by Dept. P, Bradley Washfountain Co., N. 22nd & W. Michigan Sts., Milwaukee, Wis.

WELDING Welder Specifications Bulletin No. 314-A, issued by the Lincoln Electric Co., Cleveland, Ohio, discusses features of the 150-amp. "Shield-Arc Junior" welder.

NEW BOOKS

METALS HANDBOOK, 1939 EDITION—*1,803 pages, 5¾ x 8¾ in. Indexed and illustrated. Clothboard binding. Published by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio. Price, to A.S.M. members, $7.50; to non-members, $12.50.*

With this new edition of a well-established reference work, the American Society for Metals approaches still closer to its ideal of creating a complete handbook on the subject of metals. The material has been revised and amplified to keep pace with the progress of a fast-moving industry.

Following the pattern set up by Past President R. S. Archer in previous editions, the subject matter has been divided into two main sections, ferrous and non-ferrous, under each of which are a number of subdivisions. These deal with the manufacture, treatment and application of metals of all kinds and descriptions. The producer, the user and the student of the subject will find here the answers to many questions concerning metallurgy and metal products.

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MECHANICAL ENGINEERING AS A CAREER—*Edited by a board headed by John A. Lapp, formerly head of the Department of Social Sciences, Marquette University. 20 pages, 8¼ x 11 in. Paper binding. Published by the Institute for Research, 537 S. Dearborn St., Chicago. Price, $1.*

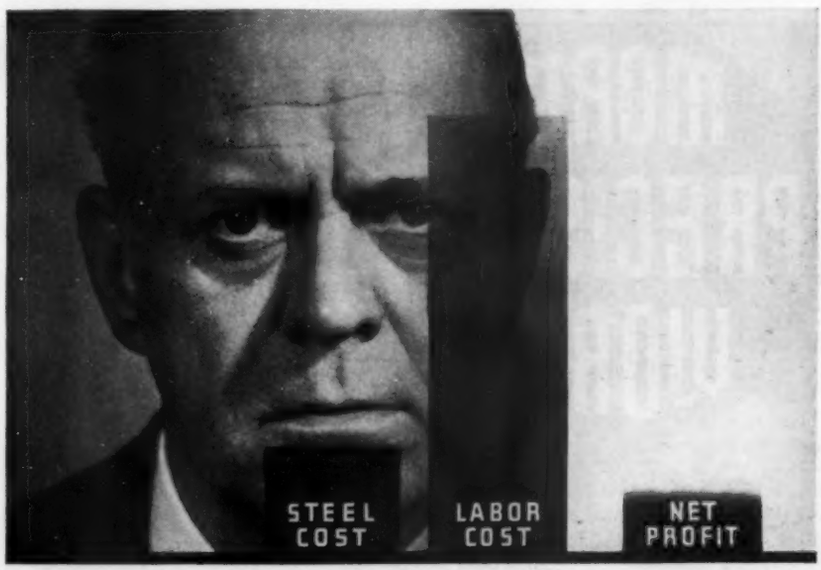
This booklet appears to be directed to the student in the process of selecting a vocation. It surveys briefly the salient facts having to do with mechanical engineering as a profession.

The survey outlines, in general, the functions of a mechanical engineer and gives an idea of the processes by which he works. The opportunities in this field are briefly summarized, with types of positions listed and a short description given of the duties which these positions entail. Typical college curriculums are discussed together with a short outline of cooperative training plans. In concluding, this study directs attention to the economic status of the mechanical engineer, his opportunities in industry, the advantages he enjoys and something of the limitations of the profession.

TO THE EDITOR

Dear Sir:

Referring to your article on "Hand Forged Knives Rare" (*AM*—Vol. 83, page 218) this article could be interpreted as a challenge to the tool steel industry of today. It is my thought that some good informative reading could be got if you would



Consider Labor Costs When Buying Steel

On most jobs, shop labor costs are the biggest single factor—and they depend to a large degree on the steel used. If bars are too hard for bending or forming—or have hard spots to break or dull tools—if some shapes are not straight—or if in the case of alloy steel the required properties are not developed by the first heat treatment—then up go costs, down go profits.

Purchasing steel that is uniform and has the properties most desirable for your particular use often pays big dividends in the form of decreased shop costs. You do not have to pay any more for this kind of steel—so why not get it?

For several years Ryerson has been building up stocks of these better, more uniform steels. Careful selection, checking, testing, and inspecting assure the uniform high quality necessary for Ryerson Certification. Try Ryerson Certified Steels on your hardest job—and check the labor costs. Many have told us that it pays.

JOSEPH T. RYERSON & SON, INC. *Plants at:* Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON *Certified* **STEELS**

RYERSON CERTIFIED STEELS

contact some of the leading steel manufacturers on this subject.

In other words, does it mean that the public in future will get inferior knives, or will they get possibly even better knives due to the technical advance in the knowledge of steel metallurgy, thus offsetting the improved steel of the past, made so simply by the working or hammering of a low grade steel by the workman.

Would like to see an article published on this.

Yours truly,
P. Bentley
Calgary, Alberta, Canada

Where Is My Wandering Job Today?

By ED WEST

"We were always losing track of some part of a job around here. Since we don't have a production shop, where parts go through in quantity and can be stacked up in tote pans, it was a problem to keep parts from straying away.

"Pete, here, might start a job but when he was about half done the foreman might give him a rush job. The unfinished part kicked around Pete's bench or lathe for a while and nobody knew quite where it was or when it would be finished.

"You see these platforms? They did the trick for us."

Made of heavy lumber the platforms were about 8 in. high and 4 to 8 ft. square depending on available space, size of department and type of work. Each department had two platforms: one for incoming and partly finished work, another for finished work ready for inspection and the next department.

"All the pieces and job tickets are deposited on these platforms when they are not actually in process. In that way we always know the status of every job.

"Another thing we discovered after we started this system was that our lower priority jobs didn't linger as long in the departments. They were always there on the platform calling attention to the fact that they weren't finished."

Work for Idle Hands

By GORDON W. RICHARDS

When work becomes slack in some plants, it is often difficult to find suitable jobs for apprentices to do. However, one plant has fallen upon what seems to be a good idea. Finding that a good many of the machines throughout the plant could use additional safety guards, the apprentices were set to work making and applying these devices. Besides serving safety, it was good training for the boys. Practically every machine required a different guard, and the designing was left entirely up to them. And they did a good job, too, the management reports.

Then there is another tried cure for slack periods as they effect apprentices. Another organization, also finding virtually no work at hand, decided to allow the boys to make and sell home workshop equipment such as drill presses, handsaws, and other small tools. The time spent thus was the boys' own—but profits from sales were all theirs. This plan likewise proved highly successful; neither party feels that time was lost.

Inspection of product varies widely in different industries. Motor car builders say that every ninth man in an automobile plant inspects parts. In one anti-friction bearing plant it is said to be one in three of the shop force.

MORE PRECISION WORK

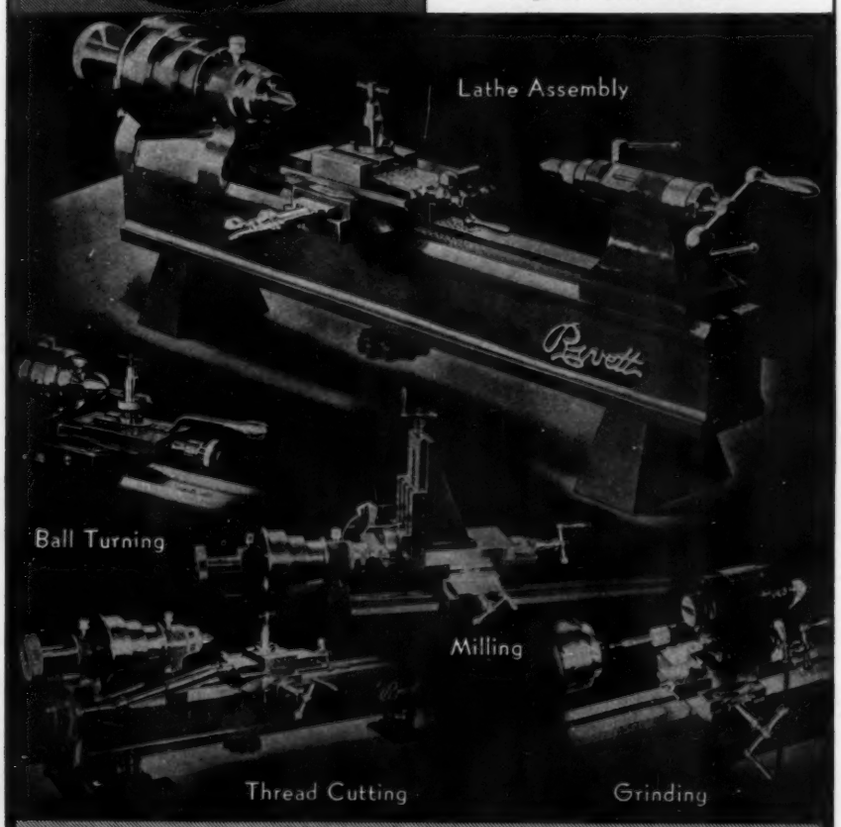
On Rivett 505

The correct lathe can be furnished in the 505 series for any production, tool room or experimental bench lathe work. A new 24 page bulletin covers the various sizes of plain, ball and roller bearing lathes, their complete line of attachments, mountings and drives.

Become acquainted with the possibilities for **MORE PRECISION WORK** in your shop on Rivett 505 plain bench lathes.

Write for Bulletin 505-E

RIVETT LATHE & GRINDER INC.
Brighton, Boston, Mass.



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